IRISH WATER

LEAD IN DRINKING WATER MITIGATION PLAN – 014 LOUGH MASK RWSS

SCREENING TO INFORM APPROPRIATE ASSESSMENT

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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/ European Sites 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.

Scoping: The process of deciding the content and level of detail to be included in the Screening for AA, including the key environmental issues, likely significant environmental effects and alternatives which need to be considered, the assessment methods to be employed, and the structure and contents of the Appropriate Assessment Screening Report.

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

Ryan Hanley was commissioned by Irish Water (IW) to undertake Screening for Appropriate Assessment (AA) for the proposed orthophosphate (OP) dosing (herein referred to as the Project) of drinking water supplied by Castlebar Reservoir and Sandyhill Reservoir via Tourmakeady Water Treatment Plant (WTP) to Lough Mask Regional Water Supply Scheme (RWSS), Co. Mayo.

This report comprises information in support of the Screening of the Project 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 significant effects resulting from the additional phosphorus (P) load to environmental receptors, resulting from OP 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 P.

1.1 PURPOSE OF THIS REPORT

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 sites qualifying interests and 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 2011 (as amended). In the context of the proposed project, the governing legislation is the Birds and Habitats Regulations 2011 and the "public authority" is Irish Water, specifically:

"The public authority shall determine that an Appropriate Assessment of a plan or project is not required where the plan or project is not directly connected with or necessary to the management of the site as a European Site and if it can be excluded on the basis of objective scientific information following screening under this Regulation, that the plan or project, individually or in combination with other plans or projects, will have a significant effect on a European site."

1.2 THE PLAN

Irish Water, 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 IW 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 IW'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 (IW, 2016[2]). Problems can also be caused by lead leaching from domestic plumbing components made of brass and from lead-containing solder, with the

[1] Now known as the Department of Housing, Planning and Local Government (DHPLG).

[2] Irish Water (IW) (2016) Lead in Drinking Water Mitigation Plan. https://www.water.ie/projects-plans/lead-mitigation-plan/Lead-in-Drinking-Water-Mitigation-Plan.pdf

most significant portion of the lead pipework lying outside of IW's ownership in private properties (IW, 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 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 25 µg/l, which was a reduction on the previous limit (i.e. pre 2003) of 50 µg/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 IW 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 (IW, 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. IW 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 IW. Other measures, including corrective water treatment in the form of pH adjustment and OP treatment, are being considered as an interim measure for the reduction of lead concentrations in drinking water in some WSZs.

IW proposes to introduce corrective water treatment at up to 400 WTPs. This would be rolled out over an accelerated 3-year 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 (OP) is added in the form of Phosphoric acid - a clear, odourless liquid that is safe for human consumption. Phosphoric acid is already 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 P every day as part of the normal diet. The OP dose rate for Lough Mask RWSS will be 0.6 mg/l P for water supplied by Castlebar Reservoir and 0.6 mg/l P for water supplied by Sandyhill Reservoir.

1.3 PROJECT BACKGROUND

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

The first step of Screening for AA is to identify the European sites that are in close proximity to or have a hydrological or hydrogeological connectivity to the WSZs affected by the proposed OP dosing. The Screening recognises that for those European Sites with nutrient sensitive Qualifying Interests (habitats and species) which have connectivity to the WSZ, there are pathways for effects which require further evaluation. The Screening Report applies objective scientific information from the EAM as outlined in this document and evaluates whether the proposed dosing will give rise to significant effects on any of these European Sites, in the context of the Site Specific Conservation Objectives (SSCO) as published on the NPWS website.

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 European Sites. 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 scope of the assessment is confined to the effects upon habitats and species of European Sites. As part of the assessment, a key consideration is 'in combination' effects with other plans or projects.

Articles 6(3) and 6(4) of the Habitats Directive set out the decision-making tests for plans and projects likely to affect European Sites (Annex 1.1). Article 6(3) 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*".

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 in this Screening, 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 (2000);
- *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.

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 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 is noted this is not an exhaustive list and does not reflect liaison and/ or discussion with technical and specialist parties from IW, RPS, NPWS, IFI, EPA etc. as part of Plan development.

- Information provided by IW 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, 2013a);
- Article 17 Habitat Conservation Assessments Volume 2 (NPWS, 2013b);
- Article 17 Species Conservation Assessment Volume 3 (NPWS, 2013c);
- EPA Qualifying Interests database, (EPA, 2015) and updated EPA Characterisation Qualifying Interests database (EPA/RPS, September 2016);
- River Basin Management Plan for Ireland 2018 - 2021 - www.housing.gov.ie;
- Ordnance Survey of Ireland – Mapping and Aerial photography www.osi.ie;
- National Summary for Article 12 (NPWS, 2013d); 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 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 where the Conservation Objectives of designated sites is to be maintained/restored.

2.5.1 Identification of European Sites

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

"*A distance of 15 km 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 15 km, 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*".

A buffer of 15 km is typically taken as the initial ZoI extending beyond the reach of the footprint of a plan, although there may be scientifically appropriate reasons for extending this ZoI further depending on pathways for potential effects. With regard to the current project, the 15 km distance is considered inappropriate to screen all likely pathways for to European Sites in view of all hydrological and hydrogeological connections to aquatic and water dependant receptors. Therefore, the ZoI for this project includes all of the hydrologically connected surface water sub catchments and groundwater bodies within the WSZ.

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 (SSCOs) have been prepared for a number of individual Sites to take account of the specific QIs/ SCIs of that Site. Both the COs and SSCOs 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 SSCOs 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. COs and SSCOs 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 OP 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 2013 a, 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 species were identified as having the greatest connectivity and thus the highest sensitivity to the proposed dosing activity, and the Water Framework Directive SAC water dependency list (NPWS, December 2015), was used as part of the criteria for screening in European Sites.

3. DESCRIPTION OF THE PROJECT

3.1 DESCRIPTION OF THE PROPOSAL

Tourmakeady WTP supplies ~38,000 m^3 of potable water per day from Lough Mask to eight WSZs in Co. Mayo; two of which are the Castlebar WSZ (2200PUB1018) and the Westport Town Mixed WSZ (2200PUB1039). Water from the existing Westport WTP is mixed with water from Tourmakeady WTP

at Sandyhill Reservoir in Westport Town. Based on an assessment of the risk of lead exceedances, the recommended Plumbosolvency Control Plan for the Lough Mask RWSS is for the high risk areas of Castlebar and Westport towns to receive OP dosed water, whereas low risk areas (all other areas) will not receive it. It is recommended that OP dosing takes place at the Castlebar Reservoir site (Figure 1) (to supply Castlebar WSZ) and the Sandyhill Reservoir site (Figure 2) (to supply Westport Town Mixed WSZ). Average flows for the Castlebar and Sandyhill Reservoirs are 7,500 m^3/day and 3,319 m^3/day respectively and a fixed rate of water mains leakage of 65% is assumed for both Westport and Castlebar WSZs.

The Westport and Castlebar WSZ boundaries cover a large rural area and the Castlebar and Westport urban centres which are served by three wastewater treatment plant (WWTP) agglomerations (Castlebar WWTP, Westport WWTP and Turlough WWTP). The boundary of the Castlebar WSZ reaches the outskirts of Westport and some of the Castlebar WSZ area is served by the Westport Agglomeration. All three WWTP agglomerations are licenced in accordance with the requirements of the Waste Water Discharge (Authorisation) Regulations 2007 as amended and the impact of the OP on the emission limit values and the receiving water body downstream of the point of discharge are assessed. The density of water mains is relatively low across the rural areas. There are an estimated 2,127 properties across the WSZs that are serviced by Domestic Wastewater Treatment Systems (DWWTS).

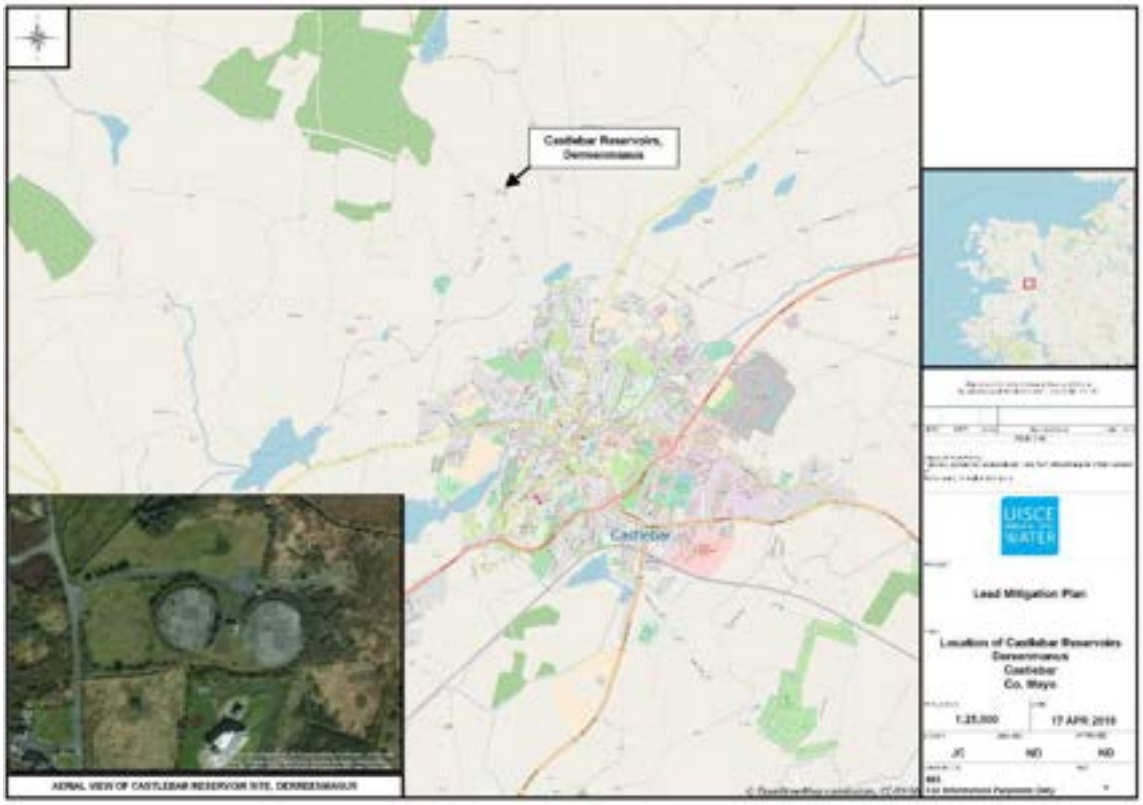

Figure 1 Location of the Castlebar Reservoir site, Derreenmanus, Co. Mayo.

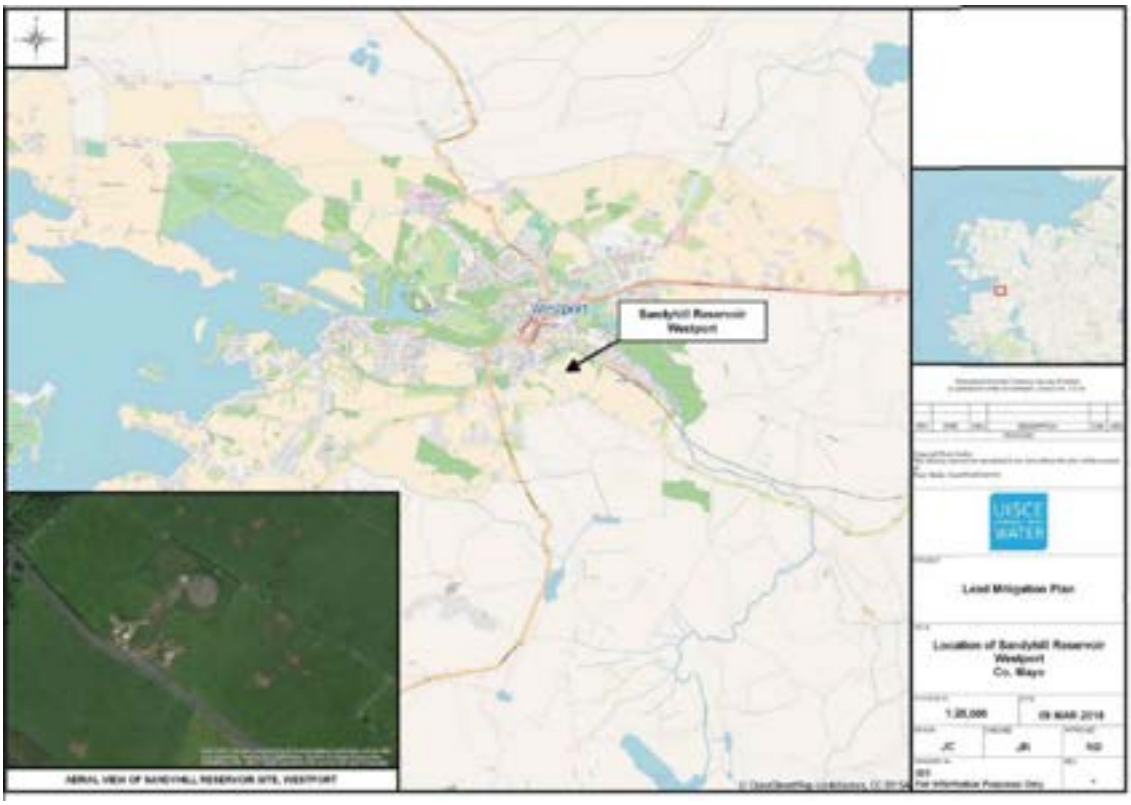

Figure 2 Location of the Sandyhill Reservoir site, Westport, Co. Mayo.

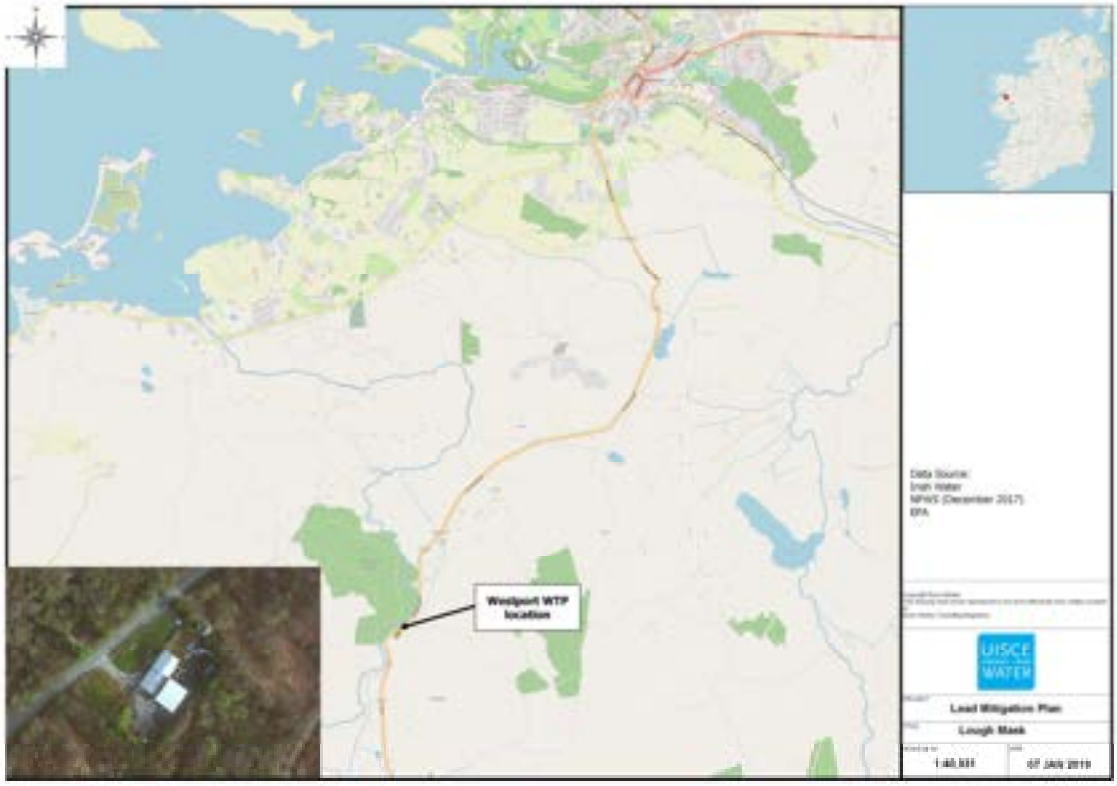

Figure 3 Location of the Westport WTP site, Westport, Co. Mayo

3.1.1 Construction Works

The Plumbosolvency Report has proposed that a bunded phosphoric acid storage tank (with capacity for a minimum of 60 days dosing of phosphoric acid at 75% concentration into supply) and dosing installations housed in kiosks, will be installed on constructed concrete ground slabs, located within the site of the existing Castlebar and Sandyhill Reservoir Sites. The required 60 days storage volume at Castlebar and Sandyhill Reservoir sites corresponds to 1 m^3 and 0.5 m^3 respectively.

Furthermore, the Plumbosolvency Report has proposed that facilities for post treatment pH correction be provided for Westport WTP Recommended pH for Westport WTP is pH of 8.0. These facilities will consist of two free standing storage or dry chemical dilution tanks (with capacity for a minimum of 60 days dosing of sodium hydroxide or sodium carbonate) with dosing pumps and control panel and an allowance for dry product storage (pallets / silos) plus conveying equipment. The two free standing storage tanks will hold circa 2 m^3 each.

The scope of the **construction** works for the Castlebar and Sandyhill Reservoir sites will include OP dosing facility installations and the Westport WTP site (Figure 3) will include pH correction facility installations as outlined below:

- Initial site assessment, and site investigation works to determine existing conditions, services and pipe cable duct layouts at the site;

- Installation of pH correction facilities with an area of approximately 30 m^2 for sodium hydroxide or sodium carbonate (a typical liquid chemical/sodium hydroxide installation is shown in **Figure 4**). Exact locations will be confirmed following initial site assessment and investigations.

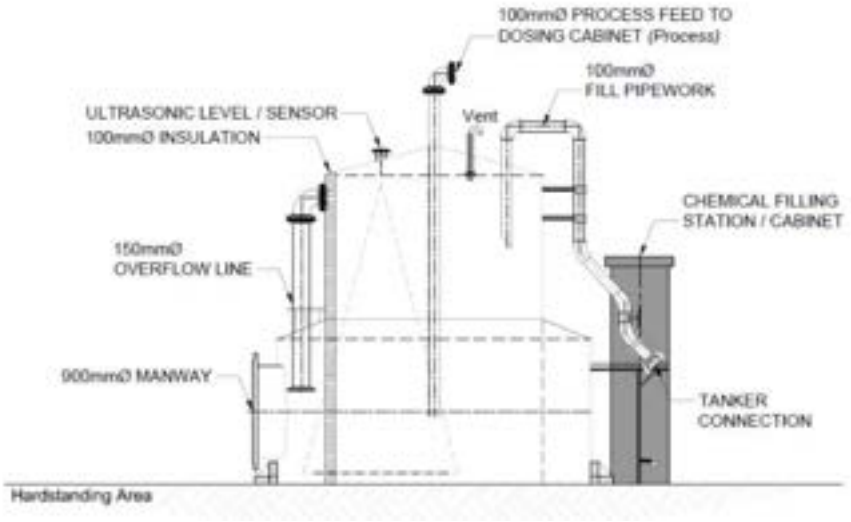

Figure 4 Sectional view of typical circular free-standing chemical storage tank.

- Installation of OP dosing units with an area of approximately 30 m^2 (a typical dosing unit is shown in **Figure 5** and **Figure 6**). Exact locations will be confirmed following initial site assessment and investigations. Kiosks will be required at the Castlebar and Sandyhill Reservoir Sites to house the OP dosing unit as there is insufficient storage space within the existing buildings. Kiosks will be housed on a concrete base with cast in ducts within the Reservoirs sites boundaries. A 1.0 m wide concrete apron shall extend around the kiosk;

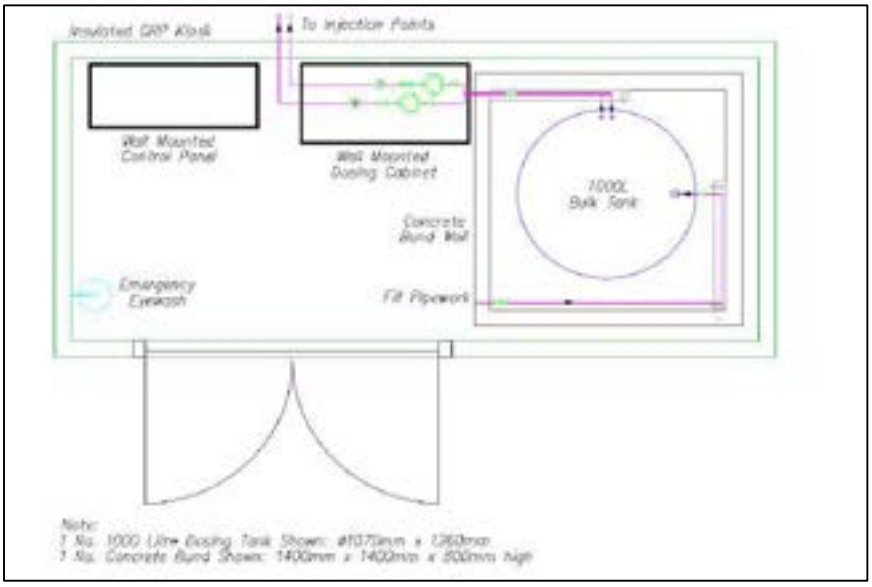

Figure 5 IW schematic of a bulk tank kiosk layout in H3PO4 Installation with 500 litres< bulk storage ≤ 6,000 litres.

Figure 6 Typical orthophosphate dosing unit

3.1.2 Operational Works

The scope of the **operational** works includes the dosing of OP to treated water at a rate of 0.6 mg/l P for treated water from Sandyhill Reservoir, and 0.6 mg/l P for treated water from Castlebar Reservoir in a process similar to the addition of chlorine for disinfection. Similarly, pH correction will involve dosing NaOH/ Na_2CO_3 to treated water.

3.2 LDWMP APPROACH TO ASSESSMENT

3.2.1 Work Flow Process

In line with the relevant guidance, the Screening Report to inform AA comprises two main steps:

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

At the early stages of consideration, IW identified the pathways by which the added OP 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, IW devised a conceptual model based on the 'source – pathway – receptor' framework. This sets out a specific environmental risk assessment of any proposed OP treatment and provides a methodology to determine the risk to the receiving environment of this corrective water treatment.

This conceptual Environmental Assessment Model (EAM), has been discussed with the EPA and has been developed using EPA datasets including the OP 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 DWWTS.

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, as influenced by the Plumbosolvency Report and EAM output, 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 is 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 3.2.2** below.

3.2.2 Environmental Assessment Methodology

The EAM has been developed based on a conceptual model of P transfer (see **Figure 7**), based on the source-pathway-receptor model, from the water distribution and wastewater collection systems.

- The *source* of phosphorus is defined as the OP dosing at WTPs 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 DWWTS.
- *Receptors*, and their sensitivity, is of key consideration in the EAM. A waterbody 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 an SAC/SPA is hydrologically connected to dosing from more than one WSZ, the potential for cumulative impacts on OP indicative water quality are considered in the EAM.

A flow chart of the methodology applied in the EAM is provided in **Figure 8** 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 OP 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 is available in **Appendix C**, which further outlines P dynamics and the consideration of P trends and capacity in receiving waters and the potential for any impact on OP indicative water quality status from an increase in OP loading arising from the proposed OP dosing.

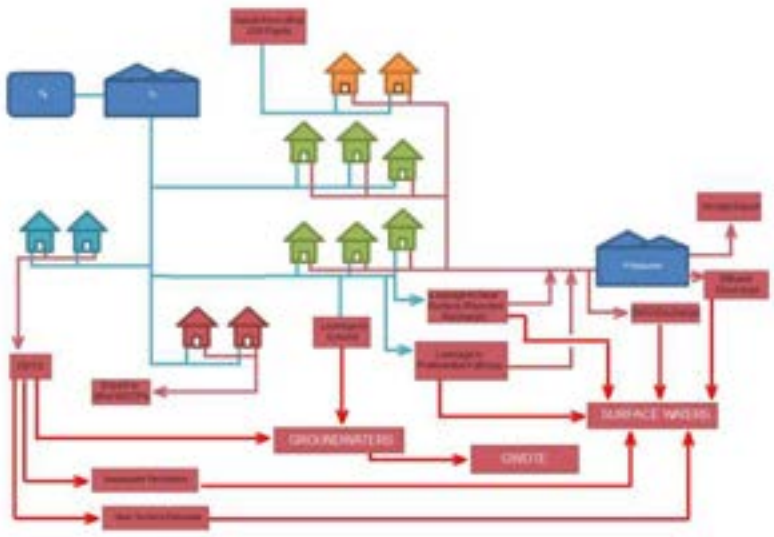

Figure 7 Conceptual Model of P Transfer

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.

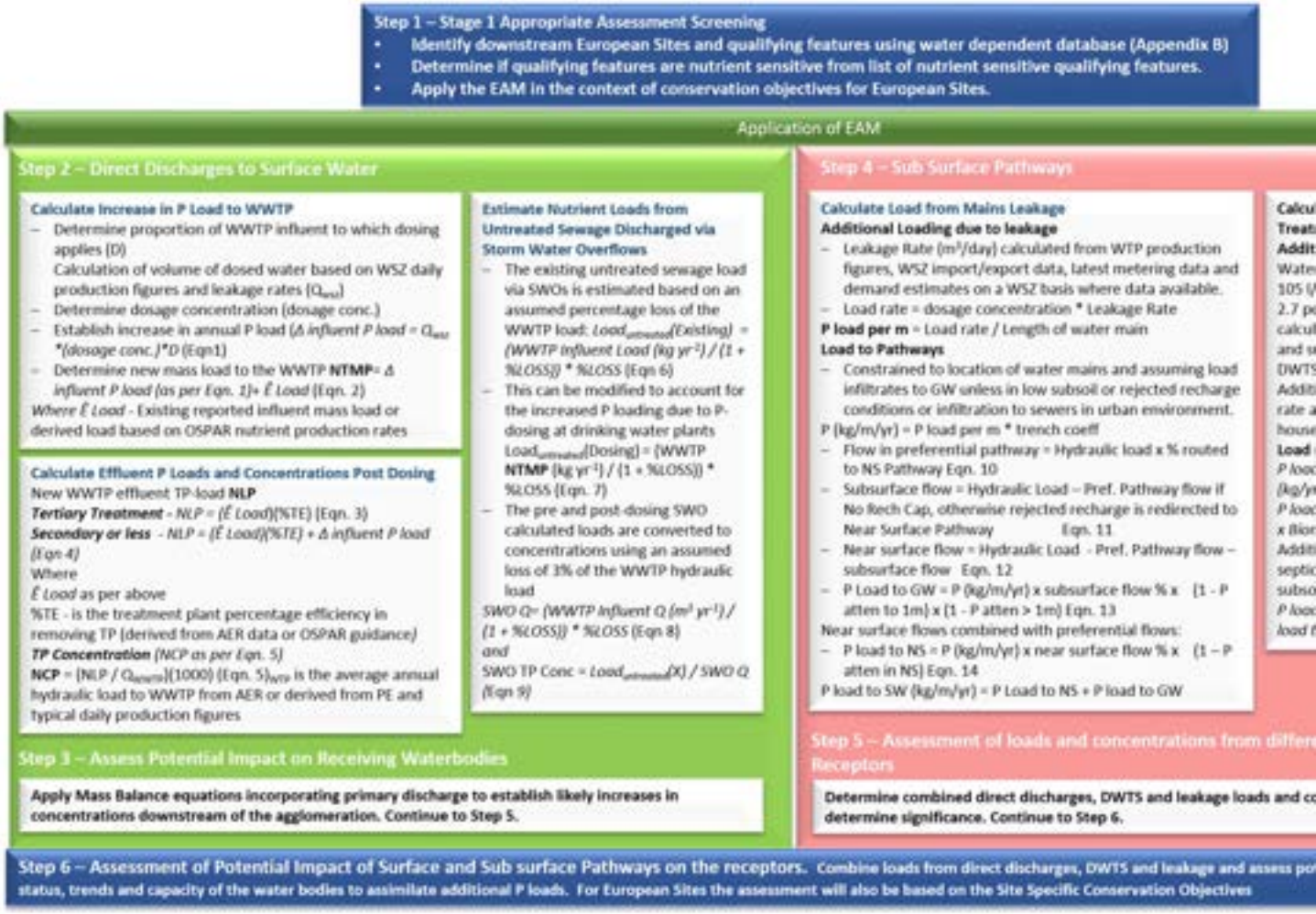

Figure 8 Stepwise Approach to the Environmental Assessment Methodology

4. PROJECT CONNECTIVITY TO EUROPEAN SITES

4.1 OVERVIEW OF THE PROJECT ZONE OF INFLUENCE

4.1.1 Construction Phase

The Castlebar Reservoir and Sandyhill Reservoir are both a significant distance from any European Site (over 2 km from the River Moy SAC and 1.5 km from Clew Bay Complex SAC respectively). Given the location (outside of any European Site boundary and away from watercourses) and scale (~30 m^2) of the construction of OP Dosing Units for the proposed scheme, located entirely within the existing reservoir site boundaries, it is considered that the potential for direct and indirect impacts arising during will not cause a significant effect on any European Sites, and henceforth are screened out (**Figure 9** and **Figure 10**). Consideration of potential impact is in the absence of mitigation and with the acknowledgement that the Dosing Units are within the existing IW site and the construction elements do not include any designated European Sites within the Zone of Influence. Therefore construction impacts are not assessed further.

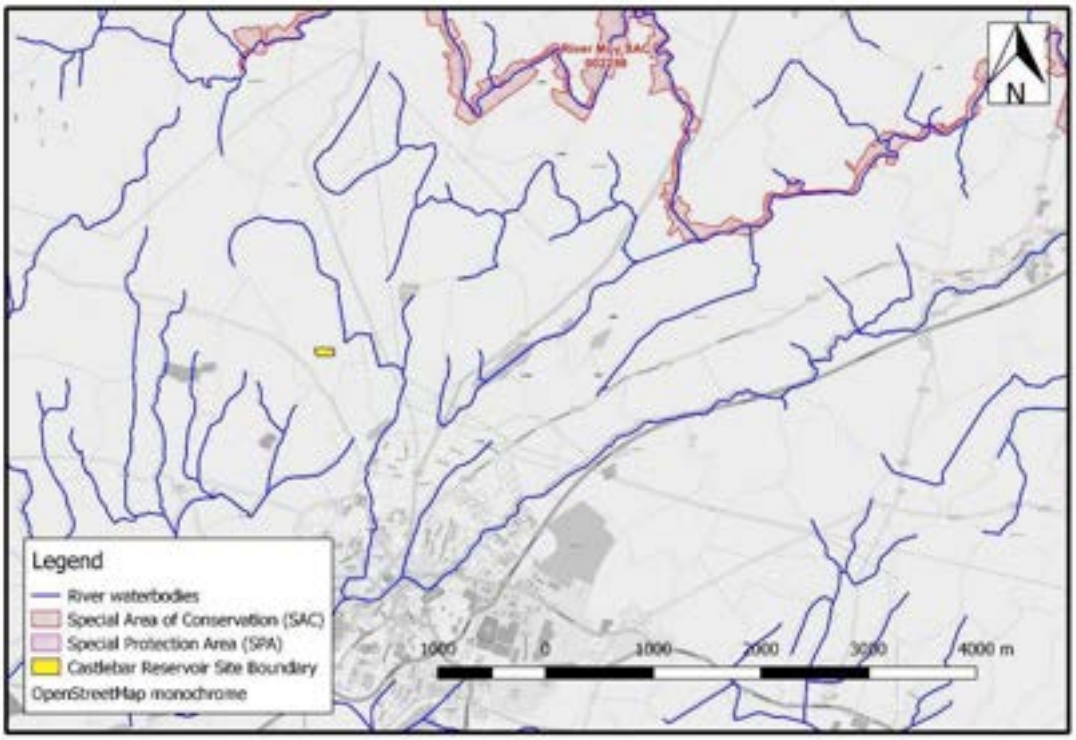

Figure 9 Location of the Castlebar Reservoir with respect to European Sites

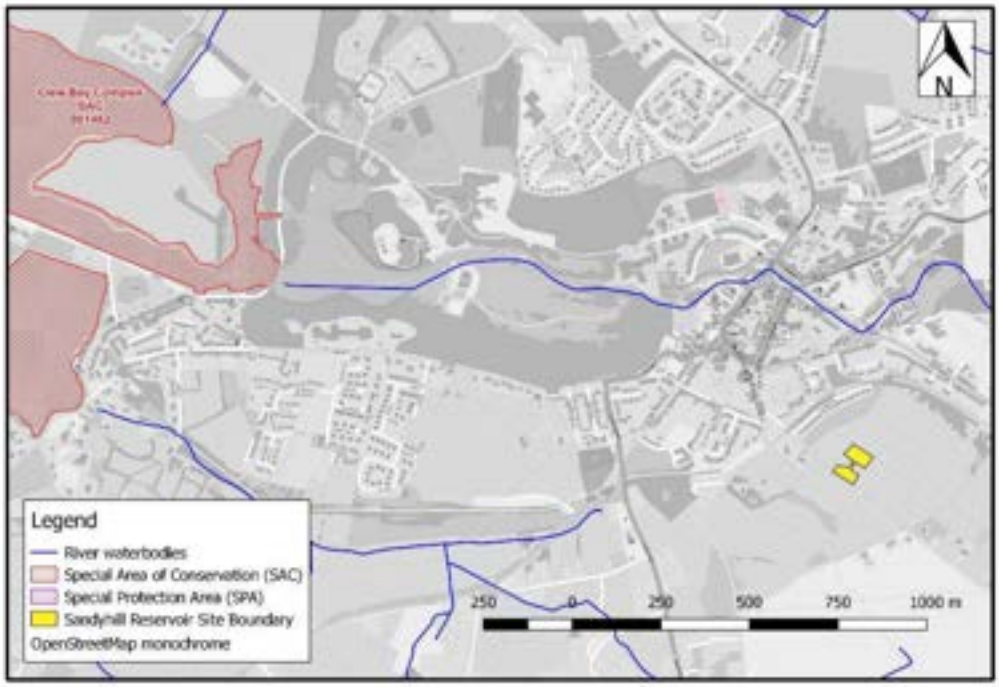

Figure 10 Location of the Sandyhill Reservoir with respect to European Sites

Westport WTP is located approximately 5.7 km south of the closest European Site (Clew Bay Complex SAC). The closest watercourse to the proposed works is the Owenwee River which is located approximately 153 m across the Leenane Road from the works. The Owenwee River flows into Clew Bay Complex SAC approximately 10 km downstream of the proposed works area (Figure 11). Given the location (outside of any European Site boundary and away from watercourses), and scale (~30 m2) of the construction of OP Dosing Units for the proposed scheme, the potential for direct and indirect impacts arising during will not cause a significant effect on any European Sites, and henceforth are screened out. Consideration of potential impact is in the absence of mitigation and with the acknowledgement that the Dosing Units are within the existing IW site and the construction elements do not include any not include any designated European Sites within the Zone of Influence. Therefore construction impacts are not assessed further.

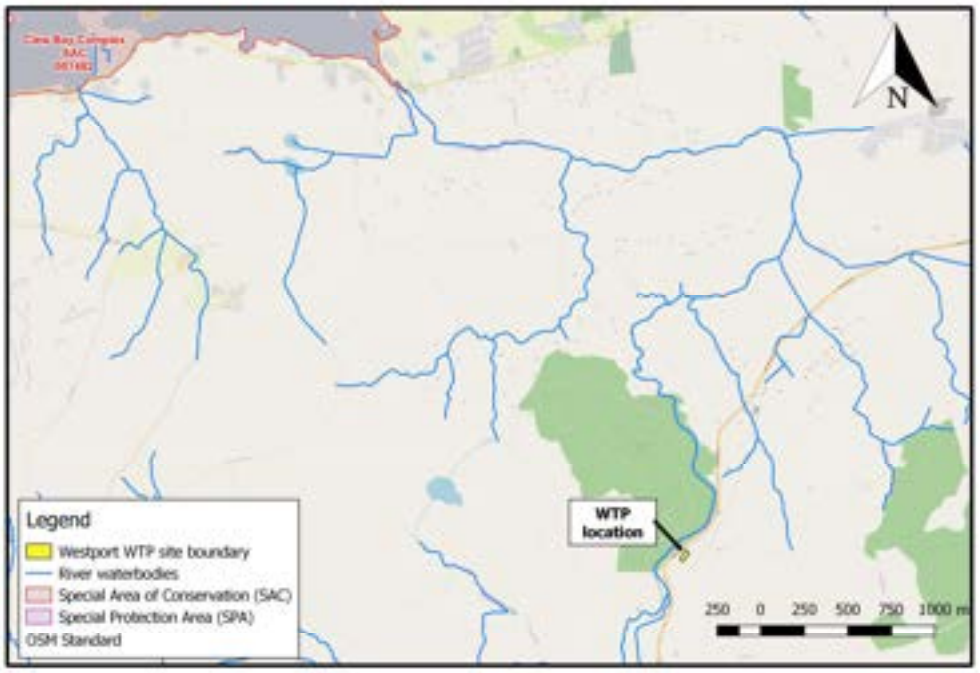

Figure 11 Location of the Sandyhill Reservoir with respect to European Sites

4.1.2 Operational Phase

With regard to the operation of the proposed project, the pathways by which the added OP may reach and / or affect environmental receptors is considered by means of a ZoI, which was determined by establishing the potential for hydrological and hydrogeological connectivity between the Castlebar and Sandyhill Reservoirs and associated WSZ and European Sites. The ZoI was therefore defined by the surface water sub-catchments and groundwater bodies that are hydrologically and hydrogeologically connected with the Project. European Sites within the ZoI are listed in **Table 1** and are displayed in **Figure 12**.

The EAM process identified 18 river waterbodies, 10 lake waterbodies and 3 transitional waterbodies potentially impacted following OP dosing of drinking water. This AA Screening identifies the connectivity between EAM identified surface waterbodies and downstream receiving waterbodies and European Sites:

- Carrowbeg (Westport)_020 (IE_WE_32C050100) river waterbody which in part contains Knappaghbeg lake (IE_WE_32_483) and drains into the Carrowbeg (Westport)_030 (IE_WE_32C050300) river waterbody before entering Westport Bay (IE_WE_350_0100) transitional waterbody and Inner Clew Bay (IE_WE_350_0000) coastal waterbody.

- Castlebar_010 (IE_WE_34C010180), which in part contains Islandeady (IE_WE_34_376) and Castlebar (IE_WE_34_403) lakes, drains into Castlebar_020 (IE_WE_34C010300), and into Castlebar_030 (IE_WE_34C010400), and Castlebar_040 (IE_WE_34C010500) before entering Lough Cullin (IE_WE_34_406a). The Moy_100 drains Lough Cullin, and is connected to the Moy_110 and the Moy_120, before entering the Moy Estuary (IE_WE_420_0300) transitional waterbody and Killala Bay (IE_WE_420_0000) coastal waterbody.

- Claureen (Mayo)_010 (IE_WE_30C120400) is connected to the OP dosing area via Ballyhean (IE_WE_G_0022) groundwater body. Claureen (Mayo)_010 , joins Claureen (Mayo)_020, Aille (Mayo)_030, Aille (Mayo)_040 which encompasses Cloon lake before joining Lough Mask. Lough Mask is connected to Lough Corrib Upper via the Cong Canal_010, Lough Corrib Lower, drained by the river waterbodies Corrib_010 and Corrib_020 before entering the Corrib Estuary transitional waterbody and Inner Galway Bay North coastal waterbody.

- Cloghan_010 (IE_WE_32C160630) river waterbody which enters Westport Bay (IE_WE_350_0100) transitional waterbody and Inner Clew Bay (IE_WE_350_0000) coastal waterbody.

- Glenisland_010 (IE_WE_32G070300) river waterbody which enters Beltra Lough (IE_WE_32_452), drained by Newport (Mayo)_010 (IE_WE_32N010020), Newport (Mayo)_020 (IE_WE_32N010050), Newport (Mayo)__030 (IE_WE_32N010190), Newport Bay (IE_WE_350_0200) transitional waterbody and Inner Clew Bay (IE_WE_350_0000) coastal waterbody.

- Owennabrockagh_010 (IE_WE_32O040500), and Cloonkeen_010 (IE_WE_32C380790) which discharge into Inner Clew Bay (IE_WE_350_0000) coastal waterbody.

- Moyour_010 (IE_WE_32M010700) which in part contains Doo (IE_WE_32_463) and Clogher (IE_WE_32_450) lakes before discharging into Inner Clew Bay (IE_WE_350_0000) coastal waterbody.

- Clydagh (Castlebar) _010 (IE_WE_34C050100), Clydagh (Castlebar_020) (IE_WE_34C010500), Castlebar_040 (IE_WE_34C010500), Lough Cullin (IE_WE_34_406a), Moy_100 (IE_WE_34M020800), Moy_110 (IE_WE_34M020850), Moy_120 (IE_WE_34M021100), Moy Estuary (IE_WE_420_0300) transitional waterbody, Killala Bay (IE_WE_420_0000) coastal waterbody.

- Crumlin (Lough Cullin)_010 (IE_WE_34C110300) river waterbody which in part enters Derryhick lake (IE_WE_34_386) before entering Lough Cullin (IE_WE_34_406a). The Moy_100 (IE_WE_34M020800) drains Lough Cullin, and is connected to the Moy_110 (IE_WE_34M020850) and the Moy_120 (IE_WE_34M021100), before entering the Moy Estuary (IE_WE_420_0300) transitional waterbody and Killala Bay (IE_WE_420_0000) coastal waterbody.

- Manulla_030 (IE_WE_34M010300), Manulla_040 (IE_WE_34M010500), which in part contains Washpool (IE_WE_34_402) and Carrowmore Manulla (IE_WE_34_304) lakes and drains into Castlebar_030 (IE_WE_34C010400), Castlebar_040 (IE_WE_34C010500), Lough Cullin (IE_WE_34_406a), Moy_100 (IE_WE_34M020800), Moy_110 (IE_WE_34M020850), Moy_120 (IE_WE_34M021100), Moy Estuary (IE_WE_420_0300) transitional waterbody, and Killala Bay (IE_WE_420_0000) coastal waterbody.

The EAM process identified 7 groundwater bodies. Groundwater bodies touching or intersecting the WSZs, are also included in the ZoI. Hydrogeological linkages in karst areas are taken into account:

- Clifden Castlebar (IE_WE_G_0017);

- Aghagower (IE_WE_G_0021);

- Ballyhean (IE_WE_G_0022);

- Newport (IE_WE_G_0023);
- Beltra Lough South (IE_WE_G_0024);
- Swinford (IE_WE_G_0033); and
- Foxford (IE_WE_G_0034).

Table 1: European Sites within the ZoI of the Proposed Project

Site Name	SAC/ SPA Code	Water Dependent Species/ Habitats	Nutrient Sensitive	Potential Hydrological/ Hydrogeological Connectivity
Galway Bay Complex SAC	000268	Yes	Yes	Yes
Levally Lough SAC	000295	Yes	Yes	No
Lisnageeragh Bog and Ballinastack Turlough SAC	000296	Yes	Yes	No
Lough Corrib SAC	000297	Yes	Yes	Yes
Lough Lurgeen Bog/ Glenamaddy Turlough SAC	000301	Yes	Yes	No
Killala Bay/ Moy Estuary SAC	000458	Yes	Yes	Yes
Ardkill Turlough SAC	000461	Yes	Yes	No
Balla Turlough SAC	000463	Yes	Yes	No
Brackloon Woods SAC	000471	No	Yes	No
Ballymaglancy Cave, Cong SAC	000474	Yes	No	No
Carrowkeel Turlough SAC	000475	Yes	Yes	No
Cloughmoyne SAC	000479	Yes	Yes	No
Clyard Kettle-Holes SAC	000480	Yes	Yes	No
Cross Lough (Killadoon) SAC	000484	Yes	Yes	No
Greaghans Turlough SAC	000503	Yes	Yes	No
Kilglassan/ Caheravoostia Turlough Complex SAC	000504	Yes	Yes	No
Shrule Turlough SAC	000525	Yes	Yes	No
Moore Hall (Lough Carra) SAC	000527	Yes	No	No
Oldhead Wood SAC	000532	No	Yes	No
Owenduff/Nephin Complex SAC	000534	Yes	Yes	No
Skealoghan Turlough SAC	000541	Yes	Yes	No
Lough Hoe Bog SAC	000633	Yes	Yes	No
Lough Nabrickkeagh Bog SAC	000634	Yes	Yes	No
Gortnandarragh Limestone Pavement SAC	001271	Yes	Yes	No
Ross Lake and Woods SAC	001312	Yes	Yes	No
Clew Bay Complex SAC	001482	Yes	Yes	Yes
Lough Cahasy, Lough Baun and Roonah Lough SAC	001529	Yes	Yes	No
Mocorha Lough SAC	001536	Yes	Yes	No
Lough Carra/ Mask Complex SAC	001774	Yes	Yes	Yes
Bellacorick Bog Complex SAC	001922	Yes	Yes	No
Mweelrea/ Sheefry/ Erriff Complex SAC	001932	Yes	Yes	No
Ox Mountains Bog SAC	002006	Yes	Yes	No
Maumturk Mountains SAC	002008	Yes	Yes	No
Connemara Bay Complex SAC	002034	Yes	Yes	No
Ballinafad SAC	002081	Yes	No	Yes
Newport River SAC	002144	Yes	Yes	Yes

Site Name	SAC/ SPA Code	Water Dependent Species/ Habitats	Nutrient Sensitive	Potential Hydrological/ Hydrogeological Connectivity
Towerhill House SAC	002179	Yes	No	Yes
Derrinlough (Cloonkeenleananode) Bog SAC	002197	Yes	Yes	No
River Moy SAC	002298	Yes	Yes	Yes
Kildun Souterrain SAC	002320	Yes	No	No
Monivea Bog SAC	002352	Yes	Yes	No
West Connacht Coast SAC	002998	Yes	Yes	No
Killala Bay/ Moy Estuary SPA	004036	Yes	Yes	Yes
Lough Corrib SPA	004042	Yes	Yes	Yes
Lough Carra SPA	004051	Yes	Yes	Yes
Lough Mask SPA	004062	Yes	Yes	Yes
Cross Lough SPA	004212	Yes	Yes	No
Lough Conn and Lough Cullin SPA	004228	Yes	Yes	Yes

4.2 IDENTIFICATION OF RELEVANT EUROPEAN SITES

Each European Site was assessed for the presence of water dependent habitats and species, nutrient sensitivity and hydrological/hydrogeological connectivity (operational and construction ZoI). A number of sites have been excluded from further assessment in Section 5 and 6, due to the absence of hydrological/hydrogeological connectivity to at least one nutrient sensitive and water-dependant QI or SCI. The remaining sites are included for further assessment in order to determine whether the Project is likely to give rise to significant effects; these sites are detailed in **Table 2.**

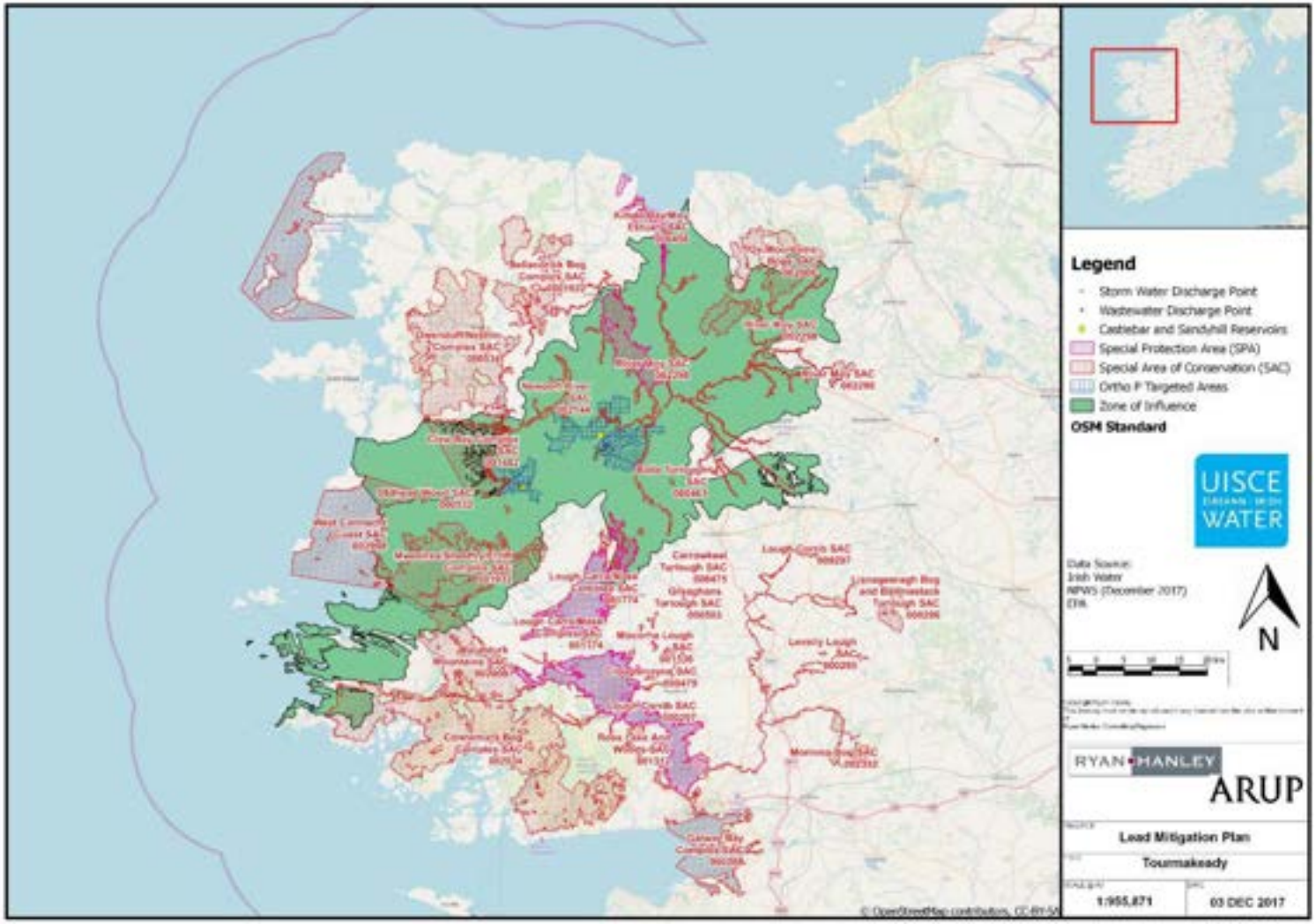

Figure 12: European Sites within the ZoI of the Proposed Project

Table 2: European Sites Hydrologically Connected to or Downstream of the WTP and WSZ

Site Name	SAC/ SPA Code	Conservation Objectives Establishment Date	Feature Code	Qualifying Interests / Special Conservation Interests	Water Dependent Species/Habitats	Nutrient Sensitive	Potential hydrological/ hydrogeological Connectivity
Galway Bay Complex	**SAC 000268**	**16th Apr 2013**	1140	Mudflats and sandflats not covered by seawater at low tide	Yes	Yes	**Yes for operational impacts**
			1150	Coastal lagoons*	Yes	Yes	
			1160	Large shallow inlets and bays	Yes	Yes	
			1170	Reefs	Yes	Yes	
			1220	Perennial vegetation of stony banks	Yes	Yes	
			1310	*Salicornia* and other annuals colonising mud and sand	Yes	Yes	
			1330	Atlantic salt meadows (Glauco-Puccinellietalia maritimae)	Yes	Yes	
			1355	Otter *Lutra lutra*	Yes	Yes	
			1365	Harbour seal *Phoca vitulina*	Yes	Yes	
			1410	Mediterranean salt meadows (Juncetalia maritimi)	Yes	Yes	
			3180	Turloughs*	Yes	Yes	
			5130	*Juniperus communis* formations on heaths or calcareous grasslands	Yes	Yes	
			6210	Semi-natural dry grasslands and scrubland facies on calcareous substrates (*Festuco Brometalia)* (*important orchid sites)	No	Yes	
			7210	Calcareous fens with *Cladium mariscus* and species of the Caricion davallianae*	Yes	Yes	
			7230	Alkaline fens	Yes	Yes	
Lough Corrib	**SAC 000297**	**28th Apr 2017**	1029	Freshwater Pearl Mussel *Margaritifera margaritifera*	Yes	Yes	**Yes for operational impacts**
			1092	White-clawed Crayfish *Austropotamobius pallipes*	Yes	Yes	
			1095	Sea Lamprey *Petromyzon marinus*	Yes	Yes	
			1096	Brook Lamprey *Lampetra planeri*	Yes	Yes	
			1106	Salmon *Salmo salar*	Yes	Yes	
			1303	Lesser Horseshoe Bat *Rhinolophus hipposideros*	Yes	No	
			1355	Otter *Lutra lutra*	Yes	Yes	

Site Name	SAC/ SPA Code	Conservation Objectives Establishment Date	Feature Code	Qualifying Interests / Special Conservation Interests	Water Dependent Species/Habitats	Nutrient Sensitive	Potential hydrological/ hydrogeological Connectivity
			1393	Slender Green Feather-moss *Drepanocladus vernicosus*	Yes	No	
			1833	Slender Naiad *Najas flexilis*	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	
			3260	Water courses of plain to montane levels with the Ranunculion fluitantis and Callitricho-Batrachion vegetation	Yes	Yes	
			6210	Semi-natural dry grasslands and scrubland facies on calcareous substrates (*Festuco-Brometalia*) (* important orchid sites)	No	Yes	
			6410	*Molinia* meadows on calcareous, peaty or clayey-silt-laden soils (*Molinion caeruleae*)	Yes	Yes	
			7110	Active raised bogs*	Yes	Yes	
			7120	Degraded raised bogs still capable of natural regeneration	Yes	Yes	
			7150	Depressions on peat substrates of the Rhynchosporion	Yes	Yes	
			7210	Calcareous fens with *Cladium mariscus* and species of the *Caricion davallianae**	Yes	Yes	
			7220	Petrifying springs with tufa formation (Cratoneurion)*	Yes	Yes	
			7230	Alkaline fens	Yes	Yes	
			8240	Limestone pavements*	No	Yes	
			91A0	Old sessile oak woods with *Ilex* and *Blechnum* in the British Isles	No	Yes	
			91D0	Bog woodland*	Yes	Yes	
Killala Bay/	**SAC 000458**	**31st Oct 2012**	1014	Narrow-mouthed Whorl Snail *Vertigo angustior*	Yes	Yes	
			1095	Sea Lamprey *Petromyzon marinus*	Yes	Yes	

Site Name	SAC/ SPA Code	Conservation Objectives Establishment Date	Feature Code	Qualifying Interests / Special Conservation Interests	Water Dependent Species/Habitats	Nutrient Sensitive	Potential hydrological/ hydrogeological Connectivity
Moy Estuary			1130	Estuaries	Yes	Yes	**Yes for operational impacts**
			1140	Mudflats and sandflats not covered by seawater at low tide	Yes	Yes	
			1210	Annual vegetation of drift lines	Yes	Yes	
			1230	Vegetated sea cliffs of the Atlantic and Baltic coasts	No	Yes	
			1310	*Salicornia* and other annuals colonising mud and sand	Yes	Yes	
			1330	Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*)	Yes	Yes	
			1365	Harbour Seal *Phoca vitulina*	Yes	Yes	
			2110	Embryonic shifting dunes	No	Yes	
			2120	Shifting dunes along the shoreline with *Ammophila arenaria* (white dunes)	No	Yes	
			2130	*Fixed coastal dunes with herbaceous vegetation (grey dunes)	No	Yes	
			2190	Humid dune slacks	No	Yes	
Clew Bay Complex	**SAC 001482**	**19th Jul 2011**	1013	Geyer's whorl snail *Vertigo geyeri*	Yes	Yes	**Yes for operational impacts**
			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	
			1210	Annual vegetation of drift lines	Yes	Yes	
			1220	Perennial vegetation of stony banks	Yes	No	
			1330	Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*)	Yes	Yes	
			1355	Otter *Lutra lutra*	Yes	Yes	
			1365	Harbour seal *Phoca vitulina*	Yes	Yes	
			2110	Embryonic shifting dunes	No	Yes	
			2120	Shifting dunes along the shoreline with *Ammophila arenaria* ("white dunes")	No	Yes	
Lough Carra/	**SAC 001774**	**15th Aug 2016**	3110	Oligotrophic waters containing very few minerals of sandy plains (*Littorelletalia uniflorae*)	Yes	Yes	

Site Name	SAC/ SPA Code	Conservation Objectives Establishment Date	Feature Code	Qualifying Interests / Special Conservation Interests	Water Dependent Species/Habitats	Nutrient Sensitive	Potential hydrological/ hydrogeological Connectivity
Mask Complex			3130	Oligotrophic to mesotrophic standing waters with vegetation of the *Littorelletea uniflorae* and/or *Isoeto-Nanojuncetea*	Yes	Yes	**Yes for operational impacts**
			3140	Hard oligo-mesotrophic waters with benthic vegetation of *Chara* spp.	Yes	Yes	
			4030	European dry heaths	No	Yes	
			6210	Semi-natural dry grasslands and scrubland facies on calcareous substrates (*Festuco Brometalia*) (*important orchid sites)*	No	Yes	
			7210	Calcareous fens with *Cladium mariscus* and species of the *Caricion davallianae**	Yes	Yes	
			7230	Alkaline fens	Yes	Yes	
			8240	Limestone pavements*	No	Yes	
			91E0	Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (*Alno-Padion, Alnion incanae, Salicion albae*)*	Yes	Yes	
			1303	Lesser Horseshoe Bat *Rhinolophus hipposideros*	Yes	No	
			1355	Otter *Lutra lutra*	Yes	Yes	
			1393	Slender Green Feather-moss *Drepanocladus vernicosus*	Yes	Yes	
Newport River	**SAC 002144**	**15th Aug 2016**	1029	Freshwater Pearl Mussel *Margaritifera margaritifera*	Yes	Yes	**Yes for operational impacts**
			1106	Salmon *Salmo salar*			
River Moy	**SAC 002298**	**3rd Aug 2016**	1092	White-clawed Crayfish Austropotamobius pallipes	Yes	Yes	**Yes for operational impacts**
			1095	Sea Lamprey *Petromyzon marinus*	Yes	Yes	
			1096	Brook Lamprey *Lampetra planeri*	Yes	Yes	
			1106	Salmon *Salmo salar*	Yes	Yes	
			1355	Otter *Lutra lutra*	Yes	Yes	
			7110	Active raised bogs*	Yes	Yes	
			7120	Degraded raised bogs still capable of natural regeneration	Yes	Yes	
			7150	Depressions on peat substrates of the Rhynchosporion	Yes	Yes	

Site Name	SAC/ SPA Code	Conservation Objectives Establishment Date	Feature Code	Qualifying Interests / Special Conservation Interests	Water Dependent Species/Habitats	Nutrient Sensitive	Potential hydrological/ hydrogeological Connectivity
			7230	Alkaline fens	Yes	Yes	
			91A0	Old sessile oak woods with *Ilex* and *Blechnum* in the BI	No	Yes	
			91E0	Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (*Alno-Padion, Alnion incanae, Salicion albae*)*	Yes	Yes	
Killala Bay/ Moy Estuary	**SPA 004036**	**28th May 2013**	A137	Ringed Plover *Charadrius hiaticula*	Yes	Yes	**Yes for operational impacts**
			A140	Golden Plover *Pluvialis apricaria*			
			A141	Grey Plover *Pluvialis squatarola*			
			A144	Sanderling *Calidris alba*			
			A149	Dunlin *Calidris alpina alpina*			
			A157	Bar-tailed Godwit *Limosa lapponica*			
			A160	Curlew *Numenius arquata*			
			A162	Redshank *Tringa totanus*			
			A999	Wetlands			
Lough Corrib	**SPA 004042**	**15th Aug 2016**	A051	Gadwall *Anas strepera*	Yes	Yes	**Yes for operational impacts**
			A056	Shoveler *Anas clypeata*	Yes	Yes	
			A059	Pochard *Aythya ferina*	Yes	Yes	
			A061	Tufted Duck *Aythya fuligula*	Yes	Yes	
			A065	Common Scoter *Melanitta nigra*	Yes	Yes	
			A082	Hen Harrier *Circus cyaneus*	Yes	Yes	
			A125	Coot *Fulica atra*	Yes	Yes	
			A140	Golden Plover *Pluvialis apricaria*	Yes	Yes	
			A179	Black-headed Gull *Chroicocephalus ridibundus*	Yes	Yes	
			A182	Common Gull *Larus canus*	Yes	Yes	
			A193	Common Tern *Sterna hirundo*	Yes	Yes	
			A194	Arctic Tern *Sterna paradisaea*	Yes	Yes	
			A395	Greenland White-fronted Goose *Anser albifrons flavirostris*	Yes	Yes	
Lough Carra	**SPA 004051**	**15th Aug 2016**	A182	Common Gull *Larus canus*	Yes	Yes	**Yes for operational impacts**
			A061	Tufted Duck *Aythya fuligula*	Yes	Yes	

Site Name	SAC/ SPA Code	Conservation Objectives Establishment Date	Feature Code	Qualifying Interests / Special Conservation Interests	Water Dependent Species/Habitats	Nutrient Sensitive	Potential hydrological/ hydrogeological Connectivity
Lough Mask	**SPA 004062**	**15th Aug 2016**	A179	Black-headed Gull *Chroicocephalus ridibundus*			**Yes for operational impacts**
			A182	Common Gull *Larus canus*			
			A183	Lesser Black-backed Gull *Larus fuscus*			
			A193	Common Tern *Sterna hirundo*			
			A395	Greenland White-fronted Goose *Anser albifrons flavirostris*			
Lough Conn and Lough Cullin	**SPA 004228**	**15th Aug 2016**	A061	Tufted Duck *Aythya fuligula*	Yes	Yes	**Yes for operational impacts**
			A065	Common Scoter *Melanitta nigra*			
			A182	Common Gull *Larus canus*			
			A395	Greenland White-fronted Goose *Anser albifrons flavirostris*			

* indicates a priority habitat under the Habitats Directive

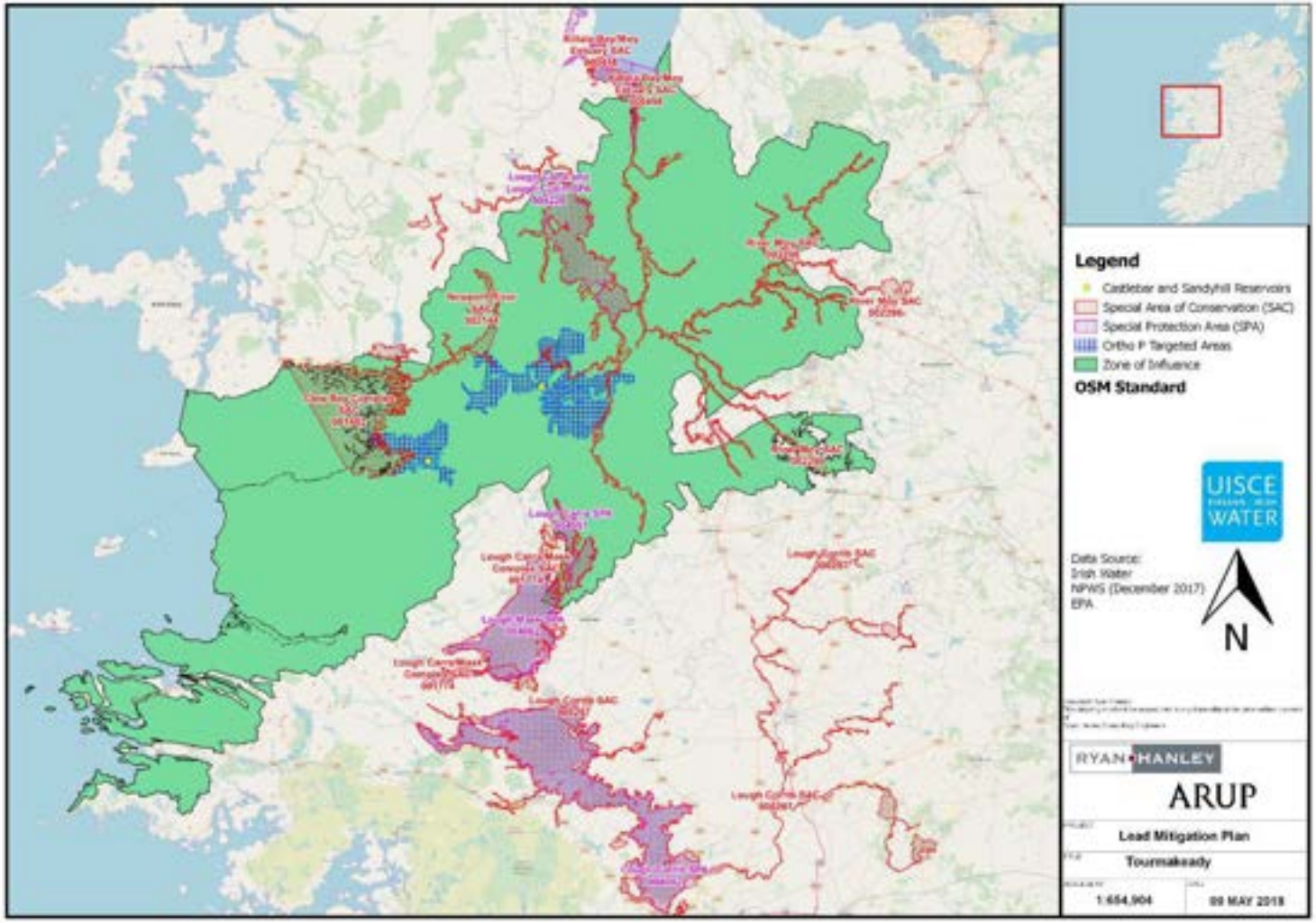

Figure 13: European Sites within the ZoI of the Proposed Project which are hydrologically or hydrogeologically connected

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 impacts;
- Short and long-term impacts;
- Construction, operational and decommissioning impacts; and
- Isolated, interactive and cumulative impacts.

5.2 IMPACT IDENTIFICATION

Operational Phase

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

The AA has considered the potential for the following significant effects to occur:

- 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).

The source-pathway-receptor approach has identified a number of impact pathways associated with the orthophosphate dosing. These will be evaluated in relation to the potential for significant effects to any European Site with regard 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 effects on these habitats and species; and therefore will be subject to an evaluation of the significance of any such effect;
- The discharge of additional P loads to the environment (through surface and sub surface pathways) may have implications for nutrient sensitive species such as the freshwater pearl mussel, Atlantic salmon and the white-clawed crayfish.
- Phosphorus (P) in wastewater collection systems is the result of drinking water and derived from a number of other sources, including P imported from areas outside the agglomeration through

import of sludges or leachates for treatment at the plant. The disposal and use of P 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 OP;
- Direct discharges of increased P to waterbodies from the wastewater treatment plant licensed discharges; and
- Potential discharges to waterbodies of untreated effluent potentially high in OP 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 potential for significant effects arising from the additional OP load due to OP dosing at Castlebar and Sandyhill Reservoirs. The conceptual model developed for OP transfer identified the surface and groundwater bodies that have the potential to be impacted by the OP dosing and which could provide a hydrological or hydrogeological pathway to the European Sites. These waterbodies are listed in **Table 3**. The table identifies the following:

- European sites included for assessment;
- Waterbodies hydrologically or hydrogeologically connected to the European Sites;
- Existing OP indicative water quality and trend of each waterbody;
- The baseline OP concentration of each waterbody;
- 75% of the upper threshold;
- Cumulative OP load to surface from leakage, DWWTS and agglomerations;
- The modelled OP concentration following dosing at the WTP; and,
- The OP potential baseline concentration (mg/l) following dosing at the WTP.

The EAM has been completed assuming the capacity of a water body is a measure of its ability to absorb extra pressures before its status changes. For example, a river water body at Good Status will have mean phosphate values in the range 0.025 to 0.035 mg/l P. River water bodies with mean phosphate concentrations of 0.0275 mg/l P have 75% capacity left, i.e. high capacity, while river water bodies with a mean of 0.0325 mg/l P have lower capacity (25%) as the concentrations are closer to the Good/Moderate Status boundary. In assessing the additional loads from the proposed orthophosphate dosing, the capacity of the water will be assessed. This information is available on the WFD App on a national basis using the "Distance to Threshold" parameter, where waterbodies 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 impact on orthophosphate indicative water quality (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 status 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 by 2021 even where the distance to threshold is currently assessed to be far. Where the water body baseline 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%/ <0.00125 mg/l P of the High/Good status) this test will pass as the orthophosphate dosing itself is not having a significant impact on the Orthophosphate indicative water quality and thus not having the potential for significant effects on connected European Sites in terms of aquatic and water dependant Qis/SCIs and their conservation 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 Status will not be achieved within two future river basin cycles, i.e. within the next 12 years.

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. This assessment has used the EPA WFD App data relating to waterbody monitoring and characterisation downloaded in January 2021.

Baseline OP monitoring data and associated thresholds are available for all RWBs with the exception of six RWBs. Where existing monitoring data is not available a surrogate status is derived from the Orthophosphate indicative quality of adjacent RWBs. The mid-range of that surrogate status is used as the Baseline Concentration. Surrogate 'high status' applied based on data within the catchment, precautionary principal. The mid-range of the surrogate status is used as the baseline concentration. On the basis of predicted loading, the risk of using surrogate data is excluded because even if high status was ascribed, the loading values are significantly below the 0.00125 mg/l P significance threshold and would not register a significant effect even on high status waterbodies with QI receptors that require high status such.

Table 3: 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[3]	Ortho P Status[4] and Trends[5]	Baseline[6] P Conc.[7] (mg/l)	75% of Status Threshold (mg/l)	Cumulative P load to SW and GW[8]	Modelled Conc.[9] (mg/l)	Baseline Conc. @ 0.6 mg/l dosing rate	Evaluation
Galway Bay Complex SAC 000268	IE_WE_30C120400 Claureen (Mayo)_010	RWB	*High*	*0.0125*	0.0188	0.6	0.00002	0.0125	No risk of deterioration to OP indicative WQ.
Lough Corrib SAC 000297	IE_WE_30C120400 Claureen (Mayo)_010	RWB	*High*	*0.0125*	0.0183	0.6	0.00002	0.0125	No risk of deterioration to OP indicative WQ.
Killala Bay/ Moy Estuary SAC 000458	IE_WE_420_0000 Killala Bay	CWB	Summer High/ Winter High	0.0125	0.0188	129.4	0.00005	0.0127	No risk of deterioration to OP indicative WQ.
	IE_WE_G_0034 Foxford	GWB	Good	0.0050	0.0263	5.3	0.0001	0.0051	No risk of deterioration to OP indicative WQ.
	IE_WE_420_0300 Moy Estuary	TWB	Summer High/ Winter High	0.0120/ 0.0070	0.0188	129.4	0.0001	0.0121/ 0.0071	No risk of deterioration to OP indicative WQ.
Clew Bay Complex SAC 001482	IE_WE_350_0000 Inner Clew Bay	CWB	Summer High/ Winter High	0.0084/ 0.0125	0.0188	177.0	0.0001	0.0085/ 0.0126	No risk of deterioration to OP indicative WQ.
	IE_WE_G_0017 Clifden Castlebar	GWB	*Good*	*0.0175*	0.0263	2.8	0.00003	0.0175	No risk of deterioration to OP indicative WQ.

[3] Monitoring period is annual unless specified.
[4] Surrogate Status indicated in italic.
[5] Distance to threshold in parentheses.
[6] Baseline year is 2014.
[7] Surrogate Status indicated in italic
[8] Cumulative P load to SW and GW from upstream and downstream dosing areas, leakage, DWWTS and agglomerations (kg/yr)
[9] Values above 5% of Good / High boundary (0.00125 mg/l) for SW or 5% of Good / Fail boundary (0.00175 mg/l) for GW highlighted in yellow.

Site Name (Code)	Contributing WB Code_Name	WB Type[3]	Ortho P Status[4] and Trends[5]	Baseline[6] P Conc.[7] (mg/l)	75% of Status Threshold (mg/l)	Cumulative P load to SW and GW[8]	Modelled Conc.[9] (mg/l)	Baseline Conc. @ 0.6 mg/l dosing rate	Evaluation
	IE_WE_G_0023 Newport	GWB	*Good*	*0.0175*	0.0263	20.6	0.0007	0.0182	No risk of deterioration to OP indicative WQ.
	IE_WE_G_0024 Beltra Lough South	GWB	*Good*	*0.0175*	0.0263	0.03	0.000002	0.0175	No risk of deterioration to OP indicative WQ.
	IE_WE_350_0100 Westport Bay	TWB	Summer High/ Winter High	0.0075/ 0.0125	0.0188	161.4	0.0002	0.0077/ 0.0127	No risk of deterioration to OP indicative WQ.
	IE_WE_350_0200 Newport Bay	TWB	Summer High/ Winter High	0.0060/ 0.0125	0.0188	15.6	0.0001	0.0061/ 0.0126	No risk of deterioration to OP indicative WQ.
	IE_WE_32MO10700 Moyour_010	RWB	*High*	*0.0125*	0.0188	6.5	0.0001	0.0126	No risk of deterioration to OP indicative WQ.
	IE_WE_32C380790 Cloonkeen_010	RWB	High	0.0125	0.0188	11.8	0.0008	0.0133	No risk of deterioration to OP indicative WQ.
	IE_WE_32C050300 Carrowbeg (Westport)_030	RWB	High	0.0070	0.0188	14.4	0.0003	0.0073	No risk of deterioration to OP indicative WQ.
	IE_WE_320040500 Owennabrockagh_010	RWB	High	0.0059	0.0188	6.9	0.0003	0.0062	No risk of deterioration to OP indicative WQ.
	IE_WE_32C160630 Cloghan_010	RWB	*High*	*0.0125*	0.0188	20.4	0.0023	0.0148	No risk of deterioration to OP indicative WQ.
Lough Carra/ Mask Complex SAC 001774	IE_WE_30C120400 Claureen (Mayo)_010	RWB	*High*	*0.0125*	0.0188	0.6	0.00002	0.0125	No risk of deterioration to OP indicative WQ.

Site Name (Code)	Contributing WB Code_Name	WB Type[3]	Ortho P Status[4] and Trends[5]	Baseline[6] P Conc.[7] (mg/l)	75% of Status Threshold (mg/l)	Cumulative P load to SW and GW[8]	Modelled Conc.[9] (mg/l)	Baseline Conc. @ 0.6 mg/l dosing rate	Evaluation
Newport River SAC 002144	IE_WE_G_0023 Newport	GWB	*Good*	*0.0175*	0.0263	20.6	0.0007	0.0182	No risk of deterioration to OP indicative WQ.
	IE_WE_G_0024 Beltra Lough South	GWB	*Good*	*0.0175*	0.0263	0.03	0.000002	0.0175	No risk of deterioration to OP indicative WQ.
	IE_WE_350_0200 Newport Bay	TWB	Summer High/ Winter High	0.0060/ 0.0125	0.0188	15.6	0.0001	0.0061/ 0.0126	No risk of deterioration to OP indicative WQ.
	IE_WE_32NO10020 Newport (Mayo)_010	RWB	High	0.0072	0.0188	15.6	0.0001	0.0073	No risk of deterioration to OP indicative WQ.
	IE_WE_32G070300 Glenisland_010	RWB	*High*	*0.0125*	0.0188	13.6	0.0007	0.0132	No risk of deterioration to OP indicative WQ.
	IE_WE_32_452 Beltra	LWB	Good	0.0129	0.0213	15.6	0.0001	0.0130	No risk of deterioration to OP indicative WQ.
River Moy SAC 002298	IE_WE_G_0034 Foxford	GWB	Good	0.0050	0.0263	5.3	0.0001	0.0051	No risk of deterioration to OP indicative WQ.
	IE_WE_G_0033 Swinford	GWB	Good	0.0070	0.0263	57.9	0.0003	0.0073	No risk of deterioration to OP indicative WQ.
	IE_WE_420_0300 Moy Estuary	TWB	Summer High/ Winter High	0.0120/ 0.0070	0.0188	129.4	0.0001	0.0121/ 0.0071	No risk of deterioration to OP indicative WQ.
	IE_WE_34C050100 Clydagh (Castlebar)_010	RWB	High	0.0058	0.0188	17.6	0.0005	0.0063	No risk of deterioration to OP indicative WQ.
	IE_WE_34C050200 Clydagh (Castlebar)_020	RWB	High	0.0063	0.0188	26.2	0.0005	0.0068	No risk of deterioration to OP indicative WQ.

Site Name (Code)	Contributing WB Code_Name	WB Type[3]	Ortho P Status[4] and Trends[5]	Baseline[6] P Conc.[7] (mg/l)	75% of Status Threshold (mg/l)	Cumulative P load to SW and GW[8]	Modelled Conc.[9] (mg/l)	Baseline Conc. @ 0.6 mg/l dosing rate	Evaluation
	IE_WE_34C110300 Crumlin (Lough Cullin)_010	RWB	*Moderate*	*0.0455*	0.0508	10.0	0.0003	0.0458	No risk of deterioration to OP indicative WQ.
	IE_WE_34C010300 Castlebar_020	RWB	Moderate	0.0075	0.0508	69.8	0.0007	0.0082	No risk of deterioration to OP indicative WQ.
	IE_WE_34C010400 Castlebar_030	RWB	Moderate	0.0125	0.0508	93.0	0.0003	0.0128	No risk of deterioration to OP indicative WQ.
	IE_WE_34C010500 Castlebar_040	RWB	High	0.0107	0.0188	119.5	0.0003	0.0110	No risk of deterioration to OP indicative WQ.
	IE_WE_34M010300 Manulla_030	RWB	High	0.0139	0.0188	14.3	0.0001	0.0140	No risk of deterioration to OP indicative WQ.
	IE_WE_34M010500 Manulla_040	RWB	High	0.0116	0.0188	16.5	0.0001	0.0117	No risk of deterioration to OP indicative WQ.
	IE_WE_34M020800 Moy_100	RWB	Moderate	0.0073	0.0508	372.1	0.0002	0.0074	No risk of deterioration to OP indicative WQ.
	IE_WE_34M020850 Moy_110	RWB	High	0.0086	0.0188	372.6	0.0002	0.0088	No risk of deterioration to OP indicative WQ.
	IE_WE_34M021100 Moy_120	RWB	High	0.0071	0.0188	409.1	0.0002	0.0073	No risk of deterioration to OP indicative WQ.
	IE_WE_34_406a Cullin	LWB	Good	0.0115	0.0213	13.3	0.0005	0.0119	No risk of deterioration to OP indicative WQ.
	IE_WE_34_386 Derryhick	LWB	*High*	0.0050	0.0075	10.0	0.0003	0.0053	No risk of deterioration to OP indicative WQ.

Site Name (Code)	Contributing WB Code_Name	WB Type[3]	Ortho P Status[4] and Trends[5]	Baseline[6] P Conc.[7] (mg/l)	75% of Status Threshold (mg/l)	Cumulative P load to SW and GW[8]	Modelled Conc.[9] (mg/l)	Baseline Conc. @ 0.6 mg/l dosing rate	Evaluation
	IE_WE_420_0000 Killala Bay	CWB	Summer High/ Winter High	0.0125	0.0188	129.4	0.00005	0.0125	No risk of deterioration to OP indicative WQ.
Killala Bay/ Moy Estuary SPA 004036	IE_WE_420_0000 Killala Bay	CWB	Summer High/ Winter High	0.0125	0.0188	129.4	0.00005	0.0125	No risk of deterioration to OP indicative WQ.
	IE_WE_G_0034 Foxford	GWB	Good	0.0050	0.0263	5.3	0.0001	0.0051	No risk of deterioration to OP indicative WQ.
	IE_WE_420_0300 Moy Estuary	TWB	Summer High/ Winter High	0.0120/ 0.0070	0.0188	129.4	0.0001	0.0121/ 0.0071	No risk of deterioration to OP indicative WQ.
Lough Corrib SPA 004042	IE_WE_30C120400 Claureen (Mayo)_010	RWB	*High*	*0.0125*	0.0188	0.6	0.00002	0.0125	No risk of deterioration to OP indicative WQ.
Lough Carra SPA 004051	IE_WE_30C120400 Claureen (Mayo)_010	RWB	*High*	*0.0125*	0.0188	0.6	0.00002	0.0125	No risk of deterioration to OP indicative WQ.
Lough Mask SPA 004062	IE_WE_30C120400 Claureen (Mayo)_010	RWB	*High*	*0.0125*	0.0188	0.6	0.00002	0.0125	No risk of deterioration to OP indicative WQ.
Lough Conn and Lough Cullin SPA 004228	IE_WE_G_0034 Foxford	GWB	Good	0.0050	0.0263	5.3	0.0001	0.0051	No risk of deterioration to OP indicative WQ.
	IE_WE_34C110300 Crumlin (Lough Cullin)_010	RWB	*Moderate*	*0.0455*	0.0508	10.0	0.0003	0.0458	No risk of deterioration to OP indicative WQ.
	IE_WE_34C010500 Castlebar_040	RWB	High	0.0107	0.0188	119.5	0.0003	0.0110	No risk of deterioration to OP indicative WQ.
	IE_WE_34_406a Cullin	LWB	Good	0.0115	0.0213	13.3	0.0005	0.0119	No risk of deterioration to OP indicative WQ.

5.3.1 Assessment of direct impact 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 the 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 within the EAM, a number of scenarios have been assessed at the agglomerations which receive water from the WSZ (**Table 4**). The baseline orthophosphate indicative water quality the existing situation prior to OP dosing is established and compared to the potential loading to the receiving waters post-dosing. In-combination impacts of the operation of the SWO and the continuous discharge from the WWTP were also assessed within the EAM.

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 OP dosing downstream of each agglomeration is provided below.

Table 4 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.

Table 4: Increased loading/concentration due to Orthophosphate Dosing – Dosing rate = 0.6 mg/l P for Castlebar Reservoir and 0.6 for Sandyhill Reservoir

Agglom. & Discharge Type	ELV from WWDL		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*
Castlebar WWTP Primary Discharge	TP - 2 mg/L Ortho-P - 0.7 mg/L	Existing	542	0.07	0.06	0.10
		Post Dosing	542	0.07	0.06	0.10
		% Increase	0	0	0	0
Castlebar WWTP SWOs (1 No.)	No ELV	Existing	326	0.21	0.17	0.29
		Post Dosing	339	0.22	0.18	0.30
Westport WWTP Primary Discharge	No ELV	Existing	1304	0.33	0.26	0.45
		Post Dosing	1550	0.39	0.31	0.53
		% Increase	21	21	21	21
Westport WWTP SWOs (1 No.)	No ELV	Existing	194	0.24	0.19	0.33
		Post Dosing	201	0.25	0.20	0.34
Turlough WWTP Primary Discharge	No ELV	Existing	116	3.74	2.99	5.08
		Post Dosing	128	4.12	3.30	5.60
		% Increase	21	21	21	21

Castlebar and Turlough Agglomerations

The Castlebar agglomeration provides tertiary treatment, i.e. chemical dosing for P removal. The ELV set for this agglomeration are 2 mg/L of TP and 0.7 mg/L for OP. These ELVs are not exceeded by the current effluent concentrations and therefore as outlined in the EAM methodology, it has been assumed that the additional P loading to the plant from OP dosing can be completely removed. Therefore, impact from OP dosing causes an estimated 0% increase in concentration levels at the plant. Castlebar agglomeration discharges into the Castlebar River (Castlebar_020 RWB) (IE_WE_34C010300) which is hydrologically connected to the River Moy SAC. The SWO concentration increases from 0.21 mg/l P to 0.22 mg/l P (7%) as a result of the OP dosing.

The Turlough agglomeration provides secondary treatment only and no ELVs have been provided for this agglomeration. Therefore, the EAM assumes that the additional P load receives no treatment. Turlough agglomeration discharges into the Castlebar River (Castlebar_020 RWB) (IE_WE_34C010300) which is hydrologically connected to the River Moy SAC. Impact from OP dosing causes an estimated 21% increase in concentration levels at the plant (**Table 4**). There is no SWO associated with the Turlough WWTP.

Westport Agglomeration

Westport agglomeration provides tertiary treatment for nitrate removal only and therefore no treatment of phosphate is assumed. No ELVs have been set for this agglomeration. Westport agglomeration discharges into Westport Bay (IE_WE_350_0100) which is hydrologically connected to Clew Bay Complex SAC. Impact from OP dosing causes an estimated 21% increase in concentration levels at the plant. The OP concentration in SWO discharges will increase from 0.24 mg P/l to 0.25 mg P/l as a result of the dosing.

5.3.2 Combined assessment of direct and indirect impacts to receiving waterbodies

This section presents the results of the EAM regarding the combined loading as a result of increased OP load from WWTP discharges, seepage from mains and DWWTS. There are no upstream dosing areas to Castlebar and Sandyhill reservoirs, however, downstream dosing areas (Kiltimagh, Clifden, Kiltimagh, Swinford and Ballina) have been considered in the relevant downstream waterbodies.

River waterbodies

- The Moyour_010 (IE_WE_32MO10700), Cloonkeen_010 (IE_WE_32C380790), Carrowbeg (Westport)_030 (IE_WE_32C050300), Owennabrockagh_010 (IE_WE_320040500) and Cloghan_010 (IE_WE_32C160630) are hydrologically connected to **Clew Bay Complex SAC (Table 3)**.

- The Newport (Mayo)_010 (IE_WE_32NO10020) and Glenisland_010 (IE_WE_32G070300) are hydrologically connected to the **Newport River SAC (Table 3)**.

- Crumlin (Lough Cullin)_010 (IE_WE_34C110300) and Castlebar_040 (IE_WE_34C010500) are hydrologically connected to the **Lough Conn and Lough Cullin SPA (Table 3)**.

- Crumlin (Lough Cullin)_010 (IE_WE_34C110300), Clydagh (Castlebar)_010 (IE_WE_34C050100), Clydagh (Castlebar)_020 (IE_WE_34C050200), Castlebar_020 (IE_WE_34C010300), Castlebar_030(IE_WE_34C010400), Castlebar_040 (IE_WE_34C010500) Manulla_040 (IE_WE_34M010500), Manulla_030

(IE_WE_34M010300), Moy_100 (IE_WE_34M020650), Moy_110 (IE_WE_34M020750) and Moy_120 (IE_WE_34M020800) are hydrologically connected to the **River Moy SAC (Table 3)**.

In addition, owing to the fact that the OP dosing area is connected to the Claureen (Mayo)_010 (IE_WE_30C120400) river waterbody via the Ballyhean (IE_WE_G_022) groundwater body, the Claureen (Mayo)_010 has also been included in the assessment. There is potential connectivity via the Claureen (Mayo)_010 to **Galway Bay Complex SAC, Lough Corrib SAC, Lough Carra/ Mask Complex SAC, Lough Corrib SPA, Lough Carra SPA and Lough Mask SPA**. The additional loading to the Claureen River as a result of dosing is 0.6 kg/yr of OP. This additional small load will have an imperceptible impact on Lough Mask, and Lough Corrib for which the TP is far from the relevant upper threshold (**Appendix C**).

For most RWBs mains leakage into the near surface pathway and groundwater account for the highest load. Castlebar and Turlough WWTP's discharge into the Castlebar River (Castlebar_020 RWB) (IE_WE_34C010300). The increase in OP concentrations in RWBs with hydrological connectivity to the OP dosing is up to 0.0023 mg/l P. All RWBs have predicted dosing concentrations below the 5% of Good/ High boundary (0.00125 mg/l P) except for Cloghan_010 (as highlighted in Table 3). However, although predicted concentrations for Cloghan_010 exceed the 5% of Good/ High boundary (0.0023 mg/l P), they are within the 75% of upper threshold and therefore there is no risk of deterioration in the status of this waterbody or any other RWBs.

Lake waterbodies

- Beltra Lake (IE_WE_32_452) is hydrologically connected to Newport River SAC;
- Derryhick and (IE_WE_34_386) Cullin lakes (IE_WE_34_406a) are hydrologically connected to the River Moy SAC; and
- Cullin Lake (IE_WE_34_406a) is hydrologically connected to Lough Conn and Lough Cullin SPA.

The assessment of impact on lakes uses a conversion factor of 0.5 from TP to OP as the status thresholds for lakes are established for TP. The increase in OP concentrations in the lake WBs with hydrological connectivity to the OP dosing is up to 0.0005 mg/l P. The resulting TP concentrations following dosing ranges from 0.0053 mg/l P to 0.0130mg/l P (**Appendix C**). The increase in concentration as a result of the OP are within the 75% of the upper threshold and therefore dosing does not cause the deterioration in the status of any lake WBs.

Groundwater bodies

- Foxford Groundwater (IE_WE_G_0034) is hydrologically linked to **Killala Bay/ Moy Estuary SAC, Killala Bay/ Moy Estuary SPA, Lough Conn and Lough Cullin SPA** and **River Moy SAC**.
- Clifden Castlebar Groundwater (IE_WE_G_0017) is hydrologically connected to **Clew Bay SAC**.
- Newport Groundwater (IE_WE_G_0023) and Beltra Lough South Groundwater (IE_WE_G_0024) are hydrologically connected to **Clew Bay SAC** and **Newport River SAC;** and
- Swinford (IE_WE_G_0033) is hydrologically connected to **River Moy SAC**.

The increase in OP concentrations in GWBs with hydrological connectivity to the OP dosing is up to 0.0007 mg/l P. All GWBs have predicted dosing concentrations below the 5% of Good/ Fail boundary (0.00175 mg/l P) (Table 3) and are within the 75% of upper threshold and therefore there is no risk of deterioration in the status of this waterbody or any other RWBs.

Transitional waterbodies

The rivers within the Tourmakeady dosing area (Castlebar & Westport) ultimately drain to the following transitional water bodies: Westport Bay, Newport Bay and the Moy Estuary.

- Moy Estuary (IE_WE_420_0300) is hydrologically linked to **Killala Bay/ Moy Estuary SAC, River Moy SAC** and **Killala Bay/ Moy Estuary SPA**.
- Westport Bay (IE_WE_350_0100) and Newport Bay (IE_WE_350_0200) are hydrologically linked to **Clew Bay SAC**.
- Newport Bay (IE_WE_350_0200) is hydrologically linked to **Newport River SAC.**

The increase in OP concentrations in the downstream transitional WBs as a result of the dosing is up to 0.0002 mg/l P. All TWBs have predicted dosing concentrations below the 5% of Good/ High boundary (0.00125 mg/l P) and are within the 75% of upper threshold and therefore there is no risk of deterioration in the status of these TWBs.

Coastal waterbodies

- Killala Bay (IE_WE_420_0000) is hydrologically linked to **Killala Bay/ Moy Estuary SAC** and **SPA**.
- Inner Clew Bay (IE_WE_350_0000) is hydrologically linked to **Clew Bay Complex SAC**.

The increase in OP concentrations in the downstream coastal WBs as a result of the dosing is up to 0.0002 mg/l P. All CWBs have predicted dosing concentrations below the 5% of Good/ High boundary (0.00125 mg/l P) and are within the 75% of upper threshold and therefore there is no risk of deterioration in the status of these CWBs.

5.3.3 Conclusions

The EAM model data identifies that additional OP dosing as part of this Project does not cause a deterioration in the OP indicative water quality of any river waterbody or groundwater body listed in **Table 3**. Concentrations from other dosing areas with regard to cumulative loading on downstream waterbodies has been considered in this assessment. Section 6 evaluates the 'no deterioration' in the context of AA and the QIs of the European Sites.

6. EVALUATION OF POTENTIAL FOR SIGNIFICANT EFFECTS

Predicted impacts for construction and operational phases of the proposed project have been investigated. Given the location of the proposed construction works in relation to European sites no potential exists for significant effects for the construction phase of the project.

The key pressure associated with the proposed OP dosing is the potential for increased OP levels in the receiving waters and the connectivity to the qualifying interest (habitats and species) identified in **Table 2** that are both water dependent and nutrient sensitive (**Appendix C**). Several of the European sites identified in **Table 2** screened out due to absence of connectivity as determined by the EAM. Furthermore the EAM highlighted that additional P load per annum from the Tourmakeady dosing area would be imperceptible on the Corrib Catchment given the scale of the catchment and existing load. Six European sites remain for evaluation of potential for significant effect: **Killala Bay/ Moy Estuary SAC (000458), Clew Bay Complex SAC (001482), Newport River SAC (002144), River Moy SAC (002298), Killala Bay/ Moy Estuary SPA (004036)** and **Lough Conn and Lough Cullin SPA (004228)**. The potential for the proposed OP dosing to give rise to significant effects on these habitats and species, in view of their conservation objectives, are assessed in detail below.

6.1 KILLALA BAY/ MOY ESTUARY SAC 000458

6.1.1 (1014) Narrow-mouthed whorl snail (*Vertigo angustior*)

Vertigo angustior is a terrestrial groundwater-dependant species. There is one known site for this species in this SAC occurring in an area of wet marsh. This site represents one of the few remaining examples of *Vertigo angustior* in its marsh "phase" and the snail has been known at this site for over 100 years. The target is to ensure 'no decline'. A review of the SSCOs targets and measures for *Vertigo angustior* found no nutrient specific targets for the species (NPWS, 2012a[10]). However, the IUCN Red List[11] of threatened species lists eutrophication as a 'main threat' to this species. Increases in P levels would allow higher vegetation to grow and outcompete the yellow sedge and moss habitat that is required by the snail.

Table 3 identifies the surface and groundwater bodies that are hydrologically or hydrogeologically connected to the proposed OP dosing and which are further connected to Narrow-mouthed whorl snail in the Killala Bay/ Moy Estuary SAC. Killala Bay/ Moy Estuary SAC is situated downstream of the OP dosing area. The EAM (**Table 3; Appendix C**) has assessed the potential for impact on OP indicative water quality on:

- Moy Estuary TWB which has a 'High' OP indicative water quality status, a baseline concentration of 0.0120 mg/l P (summer) and 0.0070 mg/l P (winter), a cumulative load of 129.4 kg/yr and baseline concentration of 0.0121 mg/l P in summer and 0.0071 mg/l P in winter following dosing. The modelled dosing concentration is below the significance threshold (0.00125 mg/l P) and does not breach the 75% upper status threshold and there is no risk of significant deterioration in water quality for this TWB.

- Foxford GWB is at 'Good' OP indicative water quality status, a baseline concentration of 0.0050 mg/l P, a cumulative load of 5.3 kg/yr, and a potential baseline concentration of 0.0051 mg/l P following dosing. The modelled dosing concentration is below the significance

[10] NPWS (2012a) Conservation Objectives: Killala Bay/Moy Estuary SAC 000458. Version 1.0. National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht.
[11] Moorkens, E., Killeen, I., Seddon, M. (2012). *Vertigo angustior*. The IUCN Red List of Threatened Species 2012: e.T22935A16658012.

threshold (0.00175 mg/l P) and does not breach the 75% upper status threshold and there is no risk of significant deterioration in water quality for this GWB.

The EAM assessment results which evaluate the additional OP loading from dosing at Castlebar and Sandyhill Reservoirs have demonstrated that there will be no change in the OP indicative water quality status of groundwater or surface waterbodies, connected to the supporting habitats for this species. Therefore potential for significant effects on the Narrow-mouthed whorl snail can be excluded.

Furthermore, dosing will not prevent the maintenance of the favourable conservation condition of the species / no deterioration of its favourable conservation condition is identified.

6.1.2 (1095) Sea Lamprey (*Petromyzon marinus*)

This SAC only covers the estuarine portion of the River Moy, the river section is dealt with in **Section 6.4** River Moy SAC. The estuary is generally in a natural state and is considered to be one of the best examples of a largely unpolluted system in Ireland. A review of the SSCOs (NPWS, 2012a[9]) for the site found no nutrient specific targets for this habitat. Adult sea lamprey spawn in open channel areas of large rivers. Young adult sea lamprey can be found migrating downriver to estuarine waters in late autumn/ winter. Young adult sea lamprey reportedly feed in estuarine waters (NPWS, 2013c[12]). Deterioration in water quality has the potential for a detrimental effect on feeding habitats, particularly where nutrient conditions result in excessive algal growth and macrophyte abundance, leading to smothering, shading effects, alteration of macroinvertebrate communities and silt deposition.

Table 3 identifies the surface and groundwater bodies that are hydrologically or hydrogeologically connected to the proposed OP dosing and which are further connected to sea lamprey in the Killala Bay/ Moy Estuary SAC. The EAM (Table 3; Appendix C) has assessed the potential for impact on OP indicative water quality on:

- Moy Estuary TWB which has a 'High' OP indicative water quality status, a baseline concentration of 0.0120 mg/l P (summer) and 0.0070 mg/l P (winter), a cumulative load of 129.4 kg/yr and baseline concentration of 0.0121 mg/l P in summer and 0.0071 mg/l P in winter following dosing. The modelled dosing concentration is below the significance threshold (0.00125 mg/l P) and does not breach the 75% upper status threshold and there is no risk of significant deterioration in water quality for this TWB.

- Killala Bay CWB which has a 'High' OP indicative water quality status, a baseline concentration of 0.0125 mg/l P (summer) and 0.0125 mg/l P (winter), a cumulative load of 129.4 kg/yr and baseline concentration of 0.0125 mg/l P in summer and 0.0125 mg/l P in winter following dosing. The modelled dosing concentration is below the significance threshold (0.00125 mg/l P) and does not breach the 75% upper status threshold and there is no risk of significant deterioration in water quality for this CWB.

The EAM assessment results which evaluate the additional OP loading from dosing at Castlebar and Sandyhill Reservoirs have demonstrated that there will be no change in the OP indicative water quality status of surface waterbodies, connected to the supporting habitats for this species. Therefore potential for significant effects on the sea lamprey can be excluded.

[12] NPWS (2013c) The Status of EU Protected Habitats and Species in Ireland. Species Assessments Volume 3. Version 1.0. Unpublished Report, National Parks & Wildlife Services. Department of Arts, Heritage and the Gaeltacht, Dublin, Ireland.

Furthermore, dosing will not prevent the maintenance of the favourable conservation condition of sea lamprey / no deterioration of its favourable conservation condition is identified.

6.1.3 (1130) Estuaries and (1140) Mudflats and sandflats not covered by seawater at low tide

'Estuaries' habitats are defined as the downstream part of a river valley, subject to the tide and extending from the limit of brackish water with a significant freshwater influence. 'Mudflats and sandflats not covered by seawater at low tide' are found exclusively between the low water and mean high water marks and contain sediment ranging from around 1 μ to 2 mm. Finer silt and clay sediments are dominant in mud flats and associated with rivers and the larger sand fractions are associated with areas exposed to significant wave energy.

The attributes and targets set out in the SSCO are: to maintain the extent of *Zostera*-dominated community, to conserve the high quality of the *Zostera*-dominated community and to conserve community types (Muddy sand to fine sand dominated by *Hydrobia ulvae*, *Pygospio elegans* and *Tubificoides benedii* community complex; Estuarine muddy sand dominated by *Hediste diversicolor* and *Heterochaeta costata* community complex; and Fine sand dominated by *Nephtys cirrosa* community complex.) in a natural condition (NPWS, 2012a[9]). Pressures and threats to this habitat associated with the current project include nutrient/ P enrichment which can be associated with accelerated growth of macroalgae/ phytoplankton or reduced concentrations of dissolved oxygen.

Table 3 identifies the surface and groundwater bodies that are hydrologically or hydrogeologically connected to the proposed OP dosing and which are further connected to these habitats in the Killala Bay/ Moy Estuary SAC. The EAM (**Table 3; Appendix C**) has assessed the potential for impact on OP indicative water quality on:

- Moy Estuary TWB which has a 'High' OP indicative water quality status, a baseline concentration of 0.0120 mg/l P (summer) and 0.0070 mg/l P (winter), a cumulative load of 129.4 kg/yr and baseline concentration of 0.0121 mg/l P in summer and 0.0071 mg/l P in winter following dosing. The modelled dosing concentration is below the significance threshold (0.00125 mg/l P) and does not breach the 75% upper status threshold and there is no risk of significant deterioration in water quality for this TWB.

- Killala Bay CWB which has a 'High' OP indicative water quality status, a baseline concentration of 0.0125 mg/l P (summer) and 0.0125 mg/l P (winter), a cumulative load of 129.4 kg/yr and baseline concentration of 0.0125 mg/l P in summer and 0.0125 mg/l P in winter following dosing. The modelled dosing concentration is below the significance threshold (0.00125 mg/l P) and does not breach the 75% upper status threshold and there is no risk of significant deterioration in water quality for this CWB.

The EAM assessment results which evaluate the additional OP loading from dosing at Castlebar and Sandyhill Reservoirs have demonstrated that there will be no change in the OP indicative water quality status of surface waterbodies, connected to these habitats. Therefore potential for significant effects on these habitats can be excluded.

Furthermore, dosing will not prevent the maintenance of the favourable conservation condition of these habitats / no deterioration of their favourable conservation condition is identified.

6.1.4 (1210) Annual vegetation of drift lines

This type of vegetation occurs on sandy, shingle or stony substrate at the upper part of the strand, around the high tide mark. Water-borne material including organic matter is deposited on the shore and provides nutrients and a seed source for vegetation. Attributes and targets set out in the SSCO relevant to the proposed project are: to maintain the presence of species-poor communities with typical species: sea rocket (*Cakile maritima*), sea sandwort (*Honckenya peploides*), prickly saltwort (*Salsola kali*) and Orache (*Atriplex* spp.); and that negative indicator species inclusive of species indicative of changes in nutrient status, are to represent < 5% cover (NPWS, 2012a[9]).

Table 3 identifies the surface and groundwater bodies that are hydrologically or hydrogeologically connected to the proposed OP dosing and which are further connected to this habitat in the Killala Bay/ Moy Estuary SAC. The EAM (**Table 3; Appendix C**) has assessed the potential for impact on OP indicative water quality on:

- Moy Estuary TWB which has a 'High' OP indicative water quality status, a baseline concentration of 0.0120 mg/l P (summer) and 0.0070 mg/l P (winter), a cumulative load of 129.4 kg/yr and baseline concentration of 0.0121 mg/l P in summer and 0.0071 mg/l P in winter following dosing. The modelled dosing concentration is below the significance threshold (0.00125 mg/l P) and does not breach the 75% upper status threshold and there is no risk of significant deterioration in water quality for this TWB.

- Killala Bay CWB which has a 'High' OP indicative water quality status, a baseline concentration of 0.0125 mg/l P (summer) and 0.0125 mg/l P (winter), a cumulative load of 129.4 kg/yr and baseline concentration of 0.0125 mg/l P in summer and 0.0125 mg/l P in winter following dosing. The modelled dosing concentration is below the significance threshold (0.00125 mg/l P) and does not breach the 75% upper status threshold and there is no risk of significant deterioration in water quality for this CWB.

The EAM assessment results which evaluate the additional OP loading from dosing at Castlebar and Sandyhill Reservoirs have demonstrated that there will be no change in the OP indicative water quality status of surface waterbodies, connected to this habitat. Therefore potential for significant effects on this habitat can be excluded.

Furthermore, dosing will not prevent the maintenance of the favourable conservation condition of this habitat / no deterioration of its favourable conservation condition is identified.

6.1.5 (1310) Salicornia and other annuals colonising mud and sand; and (1330) Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*)

Saltmarshes are stands of vegetation that occur along sheltered coasts, mainly on mud or sand, and are flooded periodically by the sea. They are restricted to the area between mid-neap tide level and high water spring tide level. Salicornia and other annuals colonising mud and sand is a pioneer saltmarsh community that can occur on muddy sediment seaward of established saltmarsh, or form patches within other saltmarsh communities where the elevation is suitable and there is regular tidal inundation (NPWS, 2012b[13]). Two out of four sub-sites that were surveyed had this habitat present. However, further surveyed areas maybe present within the site in suitable areas. Atlantic salt meadows is the dominant saltmarsh habitat at the site with four sub-sites mapped and further potential sites being noted. The SSCO supporting document on coastal habitats for Killala Bay/ Moy Estuary SAC states that the target

[13] NPWS (2012b) Killala Bay/ Moy Estuary SAC (site code: 458). Conservation objectives supporting document – coastal habitats Version 1.

is to ensure that the hydrological regime continues to function naturally and that there are no increased nutrient inputs in the groundwater.

Table 3 identifies the surface and groundwater bodies that are hydrologically or hydrogeologically connected to the proposed OP dosing and which are further connected to these habitats in the Killala Bay/ Moy Estuary SAC. The EAM (**Table 3; Appendix C**) has assessed the potential for impact on OP indicative water quality on:

- Moy Estuary TWB which has a 'High' OP indicative water quality status, a baseline concentration of 0.0120 mg/l P (summer) and 0.0070 mg/l P (winter), a cumulative load of 129.4 kg/yr and baseline concentration of 0.0121 mg/l P in summer and 0.0071 mg/l P in winter following dosing. The modelled dosing concentration is below the significance threshold (0.00125 mg/l P) and does not breach the 75% upper status threshold and there is no risk of significant deterioration in water quality for this TWB.

- Killala Bay CWB which has a 'High' OP indicative water quality status, a baseline concentration of 0.0125 mg/l P (summer) and 0.0125 mg/l P (winter), a cumulative load of 129.4 kg/yr and baseline concentration of 0.0125 mg/l P in summer and 0.0125 mg/l P in winter following dosing. The modelled dosing concentration is below the significance threshold (0.00125 mg/l P) and does not breach the 75% upper status threshold and there is no risk of significant deterioration in water quality for this CWB.

The EAM assessment results which evaluate the additional OP loading from dosing at Castlebar and Sandyhill Reservoirs have demonstrated that there will be no change in the OP indicative water quality status of surface waterbodies, connected to these habitats. Therefore potential for significant effects on these habitats can be excluded.

Furthermore, dosing will not prevent the maintenance of the favourable conservation condition of these habitats / no deterioration of their favourable conservation condition is identified.

6.1.6 (1365) Harbour seal (*Phoca vitulina*)

The harbour seal is the smaller of two species of the *Phocidae* genus that commonly breed around the coast of Ireland and has a preference for inhabiting enclosed sheltered coastal bays and estuaries. 102 seals were counted in 2010 in the Moy estuary. Attributes and targets set out by the SSCO which bear specific relevance to this project are: to conserve the breeding sites in a natural condition; to conserve the moult haul-out sites in a natural condition; to conserve the resting haul-out sites in a natural condition; and that human activities should occur at levels that do not adversely affect the harbour seal population at the site.

Table 3 identifies the surface and groundwater bodies that are hydrologically or hydrogeologically connected to the proposed OP dosing and which are further connected to the harbour seal in the Killala Bay/ Moy Estuary SAC. The EAM (**Table 3; Appendix C**) has assessed the potential for impact on OP indicative water quality on:

- Moy Estuary TWB which has a 'High' OP indicative water quality status, a baseline concentration of 0.0120 mg/l P (summer) and 0.0070 mg/l P (winter), a cumulative load of 129.4 kg/yr and baseline concentration of 0.0121 mg/l P in summer and 0.0071 mg/l P in winter following dosing. The modelled dosing concentration is below the significance threshold (0.00125 mg/l P) and does not breach the 75% upper status threshold and there is no risk of significant deterioration in water quality for this TWB.

- Killala Bay CWB which has a 'High' OP indicative water quality status, a baseline concentration of 0.0125 mg/l P (summer) and 0.0125 mg/l P (winter), a cumulative load of 129.4 kg/yr and baseline concentration of 0.0125 mg/l P in summer and 0.0125 mg/l P in winter following dosing. The modelled dosing concentration is below the significance threshold (0.00125 mg/l P) and does not breach the 75% upper status threshold and there is no risk of significant deterioration in water quality for this CWB.

The EAM assessment results which evaluate the additional OP loading from dosing at Castlebar and Sandyhill Reservoirs have demonstrated that there will be no change in the OP indicative water quality status of groundwater or surface waterbodies, connected to the harbour seal. Therefore potential for significant effects on these habitats can be excluded.

Furthermore, dosing will not prevent the maintenance of the favourable conservation condition of this species / no deterioration of its favourable conservation condition is identified.

6.2 CLEW BAY COMPLEX SAC 001482

6.2.1 (1013) Geyer's whorl snail (*Vertigo geyeri*)

There is currently no SSCO set for this species (NPWS, 2011a[14]). Furthermore there are no specific threats or pressures relating to water quality highlighted by NPWS (2013c[11]). The IUCN Red List does report eutrophication as a major threat for this species however (Killeen *et al.*, 2011[15]).

Table 3 identifies the surface waterbodies and groundwater bodies that are hydrologically or hydrogeologically connected to the proposed OP dosing and which are further connected to this species in Clew Bay Complex SAC. The EAM (**Table 3; Appendix C**) has assessed the potential for impact on OP indicative water quality:

- Clifden Castlebar GWB which has a '*Good*' OP indicative water quality status, a surrogate baseline concentration of *0.0175* mg/l P, a cumulative load of 2.8 kg/yr and baseline concentration of 0.0175 mg/l P following dosing. The modelled dosing concentration is below the significance threshold (0.00175 mg/l P) and does not breach the 75% upper status threshold and there is no risk of significant deterioration in water quality for this GWB.

- Newport GWB which has a '*Good*' OP indicative water quality status, a surrogate baseline concentration of *0.0175* mg/l P, a cumulative load of 20.6 kg/yr and baseline concentration of 0.0182 mg/l P following dosing. The modelled dosing concentration is below the significance threshold (0.00175 mg/l P) and does not breach the 75% upper status threshold and there is no risk of significant deterioration in water quality for this GWB.

- Beltra Lough South GWB which has a '*Good*' OP indicative water quality status, a surrogate baseline concentration of *0.0175* mg/l P, a cumulative load of 0.03 kg/yr and baseline concentration of 0.0175 mg/l P following dosing. The modelled dosing concentration is below the significance threshold (0.00175 mg/l P) and does not breach the 75% upper status threshold and there is no risk of significant deterioration in water quality for this GWB.

[14] NPWS (2011a) Conservation Objectives: Clew Bay Complex SAC 001482. Version 1.0. National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht.
[15] Killeen, I., Moorkens, E. & Seddon, M.B.2011. *Vertigo geyeri*. The IUCN Red List of Threatened Species 2011: e.T22940A9400082. http://dx.doi.org/10.2305/IUCN.UK.2011-2.RLTS.T22940A9400082.en.

As no impact has been predicted for Westport and Newport Bay transitional waterbodies and marine waters have a lower sensitivity to OP, no risk of deterioration in status is perceived for Inner Clew Bay coastal waterbody. Therefore there is no risk of deterioration in status for these groundwater bodies.

The EAM assessment results which evaluate the additional OP loading from dosing at Castlebar and Sandyhill Reservoirs have demonstrated that there will be no change in the OP indicative water quality status of groundwater or surface waterbodies, connected to the Geyer's whorl snail in Clew Bay Complex SAC. Therefore potential for significant effects on this species can be excluded.

The status of Geyer's whorl snail is currently under review for Clew Bay Complex SAC, however, dosing will not prevent the maintenance or restoration of the favourable conservation condition of this species / no deterioration of its conservation condition is identified.

6.2.2 (1140) Mudflats and sandflats not covered by seawater at low tide and (1160) Large shallow inlets and bays

The Large shallow inlets and bays habitat in Clew Bay Complex SAC encompasses the 'Mudflat and sandflats not covered by seawater at low tide' habitat. Sandy mud is widespread within the site where soft sediment is present with polychaetes and bivalves occurring in moderate to high densities. Fine mud dominated by *Nephtys cirrosa* is found on the south-western boundary of the site and in the outer reaches of Westport Bay. Large shallow inlets and bays further contain *Zostera* and Maërl dominated communities, which were recorded in the southern section of the site to the south and east of Inishlyre, north and east of Crovinish and southwest of Inishgort lighthouse, with smaller patches occurring in Westport Harbour. The SSCOs do not specify nutrient specific targets (NPWS, 2011a[13]) however, the marine supporting document specifies that the above communities be maintained in a 'natural condition' (NPWS, 2011b[16]. Increased nutrients could negatively impact these communities by encouraging development of unfavourable sediment conditions.

Table 3 identifies the surface waterbodies and groundwater bodies that are hydrologically or hydrogeologically connected to the proposed OP dosing and which are further connected to these habitats in Clew Bay Complex SAC. The EAM (**Table 3; Appendix C**) has assessed the potential for impact on OP indicative water quality:

- Westport Bay TWB has a 'High' OP indicative water quality status, a Summer and Winter baseline concentration of 0.0075 mg/l P and 0.0125 mg/l P respectively, a cumulative OP load of 161.4 kg/yr, potential baseline concentrations following dosing of 0.0077 mg/l P (summer) and 0.0127 mg/l P (winter) and a 'high' OP indicative water quality status following dosing. The modelled dosing concentration is below the significance threshold (0.00125 mg/l P) and does not breach the 75% upper status threshold and there is no risk of significant deterioration in water quality for this TWB.

- Newport Bay TWB has a 'High' OP indicative water quality status, a Summer and Winter baseline concentration of 0.0060 mg/l P and 0.0125 mg/l P respectively, a cumulative OP load of 15.6 kg/yr, potential baseline concentrations following dosing of 0.0061 mg/l P (summer) and 0.0126 mg/l P (winter) and a 'high' OP indicative water quality status following dosing. The modelled dosing concentration is below the significance threshold (0.00125 mg/l P) and does not breach the 75% upper status threshold and there is no risk of significant deterioration in water quality for this TWB.

[16] NPWS (2011b) Clew Bay Complex SAC (site code: 1482). Conservation objectives supporting document –marine habitats Version 1.

- Inner Clew Bay CWB has a 'High' OP indicative water quality status, a Summer and Winter baseline concentration of 0.0084 mg/l P and 0.0125 mg/l P respectively, a cumulative OP load of 177.0 kg/yr, potential baseline concentrations following dosing of 0.0085 mg/l P (summer) and 0.0126 mg/l P (winter) and a 'high' OP indicative water quality status following dosing. The modelled dosing concentration is below the significance threshold (0.00125 mg/l P) and does not breach the 75% upper status threshold and there is no risk of significant deterioration in water quality for this CWB.

The EAM assessment results which evaluate the additional OP loading from dosing at Castlebar and Sandyhill Reservoirs have demonstrated that there will be no change in the OP indicative water quality status of surface waterbodies, connected to these habitats in Clew Bay Complex SAC. Therefore potential for significant effects on these habitats can be excluded.

Furthermore, dosing will not prevent the maintenance of the favourable conservation condition of these habitats / no deterioration of their favourable conservation condition is identified.

6.2.3 (1150) * Coastal lagoons

The main lagoons in Clew Bay Complex SAC are Furnace Lough and Claggan Lagoon and it has been highlighted that there are potentially further unmapped lagoons within the site. Water pollution (eutrophication) is the believed to be the greatest future threat for most lagoons (NPWS, 2013b[17]). It is believed that historical activities such as overgrazing and afforestation resulted in increased siltation and eutrophication, but the extent of the impacts of this have not been entirely studied. The attributes and associated targets most relevant to this project include: to maintain the annual median chlorophyll in Furnace Lough at < 2.5 µg/L; to maintain annual median MRP in Furnace Lough at < 0.01 mg/L; to maintain annual median BOD in Furnace Lough at less than 2.0 mg/L; to Maintain/increase the depth of submergent macrophyte colonisation of the lagoon; to Maintain number and extent of listed flora and fauna lagoonal specialists, subject to natural variation; and that negative indicator species be kept absent or under control (NPWS, 2011a[13]). With regard to negative indicator species, increased P could give rise to eutrophication which would favour phytoplankton blooms at the expense of submerged macrophtyes.

Table 3 identifies the surface waterbodies and groundwater bodies that are hydrologically or hydrogeologically connected to the proposed OP dosing and which are further connected to coastal lagoons in Clew Bay Complex SAC. There is no direct connectivity to the two coastal lagoons identified above. Connectivity is indirect via transitional and coastal waterbodies. The EAM (**Table 3; Appendix C**) has assessed the potential for impact on OP indicative water quality:

- Westport Bay TWB has a 'High' OP indicative water quality status, a Summer and Winter baseline concentration of 0.0075 mg/l P and 0.0125 mg/l P respectively, a cumulative OP load of 161.4 kg/yr, potential baseline concentrations following dosing of 0.0077 mg/l P (summer) and 0.0127 mg/l P (winter) and a 'high' OP indicative water quality status following dosing. The modelled dosing concentration is below the significance threshold (0.00125 mg/l P) and does not breach the 75% upper status threshold and there is no risk of significant deterioration in water quality for this TWB.

- Newport Bay TWB has a 'High' OP indicative water quality status, a Summer and Winter baseline concentration of 0.0060 mg/l P and 0.0125 mg/l P respectively, a cumulative OP load of 15.6 kg/yr, potential baseline concentrations following dosing of 0.0061 mg/l P (summer)

[17] NPWS (2013b) The Status of EU Protected Habitats and Species in Ireland. Habitat Assessments Volume 2. Version 1.0. Unpublished Report, National Parks & Wildlife Services. Department of Arts, Heritage and the Gaeltacht, Dublin, Ireland

and 0.0126 mg/l P (winter) and a 'high' OP indicative water quality status following dosing. The modelled dosing concentration is below the significance threshold (0.00125 mg/l P) and does not breach the 75% upper status threshold and there is no risk of significant deterioration in water quality for this TWB.

- Inner Clew Bay CWB has a 'High' OP indicative water quality status, a Summer and Winter baseline concentration of 0.0084 mg/l P and 0.0125 mg/l P respectively, a cumulative OP load of 177.0 kg/yr, potential baseline concentrations following dosing of 0.0085 mg/l P (summer) and 0.0126 mg/l P (winter) and a 'high' OP indicative water quality status following dosing. The modelled dosing concentration is below the significance threshold (0.00125 mg/l P) and does not breach the 75% upper status threshold and there is no risk of significant deterioration in water quality for this CWB.

The EAM assessment results which evaluate the additional OP loading from dosing at Castlebar and Sandyhill Reservoirs have demonstrated that there will be no change in the OP indicative water quality status of surface waterbodies, connected to coastal lagoons in Clew Bay Complex SAC. Specifically, the SSCO to maintain the annual median MRP <0.01mg/l in Furnace Lough coastal lagoon is satisfied as the annual median MRP is <0.01 mg/l following dosing (**Table 3; Appendix C**). Furthermore the dosing concentrations of the above transitional and coastal waterbodies are below the 5% significance threshold and therefore potential for significant effects on this habitat can be excluded.

Furthermore, dosing will not prevent the maintenance of the favourable conservation condition of this habitat / no deterioration of its favourable conservation condition is identified.

6.2.4 (1210) Annual vegetation of drift lines, and (1330) Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*)

While two sub-sites have been mapped the current area of 'Annual vegetation of drift lines' is unknown in Clew Bay Complex SAC. Attributes and targets set out in the SSCO and relevant to the current project include 'to maintain the presence of species-poor communities with typical species: sea rocket (*Cakile maritima*), sea sandwort (*Honckenya peploides*), prickly saltwort (*Salsola kali*) and Atriplex spp.; and that negative indicator species inclusive of species indicative of changes in nutrient status, are to represent < 5% cover (NPWS, 2011a[13]). Ten sub-sites and additional potential areas for 'Atlantic salt meadow' habitat were mapped. There are no nutrient specific targets in the SSCO for this habitat however, there is a target to maintain the natural tidal regime (NPWS, 2011a[13]). 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 3 identifies the surface waterbodies and groundwater bodies that are hydrologically or hydrogeologically connected to the proposed OP dosing and which are further connected to these habitats in Clew Bay Complex SAC. The EAM (**Table 3; Appendix C**) has assessed the potential for impact on OP indicative water quality status:

- Westport Bay TWB has a 'High' OP indicative water quality status, a Summer and Winter baseline concentration of 0.0075 mg/l P and 0.0125 mg/l P respectively, a cumulative OP load of 161.4 kg/yr, potential baseline concentrations following dosing of 0.0077 mg/l P (summer) and 0.0127 mg/l P (winter) and a 'high' OP indicative water quality status following dosing. The modelled dosing concentration is below the significance threshold (0.00125 mg/l P) and does not breach the 75% upper status threshold and there is no risk of significant deterioration in water quality for this TWB.

- Newport Bay TWB has a 'High' OP indicative water quality status, a Summer and Winter baseline concentration of 0.0060 mg/l P and 0.0125 mg/l P respectively, a cumulative OP load of 15.6 kg/yr, potential baseline concentrations following dosing of 0.0061 mg/l P (summer) and 0.0126 mg/l P (winter) and a 'high' OP indicative water quality status following dosing. The modelled dosing concentration is below the significance threshold (0.00125 mg/l P) and does not breach the 75% upper status threshold and there is no risk of significant deterioration in water quality for this TWB.

- Inner Clew Bay CWB has a 'High' OP indicative water quality status, a Summer and Winter baseline concentration of 0.0084 mg/l P and 0.0125 mg/l P respectively, a cumulative OP load of 177.0 kg/yr, potential baseline concentrations following dosing of 0.0085 mg/l P (summer) and 0.0126 mg/l P (winter) and a 'high' OP indicative water quality status following dosing. The modelled dosing concentration is below the significance threshold (0.00125 mg/l P) and does not breach the 75% upper status threshold and there is no risk of significant deterioration in water quality for this CWB.

The EAM assessment results which evaluate the additional OP loading from dosing at Castlebar and Sandyhill Reservoirs have demonstrated that there will be no change in the OP indicative water quality status of surface waterbodies, connected to these habitats in Clew Bay Complex SAC. Therefore potential for significant effects on these habitats species can be excluded.

Furthermore, dosing will not prevent the maintenance or restoration of the favourable conservation condition of these habitats / no deterioration of their conservation condition is identified.

6.2.5 (1355) Otter (*Lutra lutra*)

A review of the SSCO found no specific attributes or targets relating to water quality (NPWS, 2011a13), however the NPWSs Threat Response Plan for the Otter (NPWS, 200918), a review of and response to the pressures and threats to otters in Ireland, categorized three principal risks to otters: i) habitat destruction and degradation; ii) water pollution; and, iii) accidental death and/or persecution. There will be no interference with the terrestrial, marine or freshwater habitat of the species as a result of this project. The broad diet of the otter varies locally and seasonally; however, it is dominated by wrasse and rockling in coastal waters.

The distribution of the otter throughout the SAC is not available directly from field surveys, areas mapped include 80 m of the shoreline based on the presumption that otters tend to forage within this range.

Table 3 identifies the surface waterbodies and groundwater bodies that are hydrologically or hydrogeologically connected to the proposed OP dosing and which are further connected to this species in Clew Bay Complex SAC. The EAM (**Table 3; Appendix C**) has assessed the potential for impact on OP indicative water quality status:

- Carrowbeg (Westport)_030 river waterbody has 'High' OP indicative water quality status, a baseline concentration of 0.0070 mg/l P, a cumulative OP load of 14.4 kg/yr, a potential concentration of 0.0073 mg/l P following dosing and a 'high' OP indicative water quality status following dosing. The modelled dosing concentration is below the significance threshold (0.00125 mg/l P) and does not breach the 75% upper status threshold and there is no risk of significant deterioration in water quality for this RWB.

[18] NPWS (2009) Threat Response Plan: Otter (2009-2011). National Parks & Wildlife Service, Department of the Environment, Heritage & Local Government, Dublin.

- Owennabrockagh_010 river waterbody has 'High' OP indicative water quality status, a baseline concentration of 0.0059 mg/l P, a cumulative OP load of 6.9 kg/yr, a potential concentration of 0.0062 mg/l P following dosing and a 'high' OP indicative water quality status following dosing. The modelled dosing concentration is below the significance threshold (0.00125 mg/l P) and does not breach the 75% upper status threshold and there is no risk of significant deterioration in water quality for this RWB.

- Cloonkeen_010 river waterbody has '*High*' OP indicative water quality status, a surrogate baseline concentration of *0.0125* mg/l P, a cumulative OP load of 11.8 kg/yr, a potential concentration of 0.0133 mg/l P following dosing and a 'high' OP indicative water quality status following dosing. The modelled dosing concentration is below the significance threshold (0.00125 mg/l P) and does not breach the 75% upper status threshold and there is no risk of significant deterioration in water quality for this RWB.

- Cloghan_010 river waterbody has '*High*' OP indicative water quality status, a surrogate baseline concentration of *0.0125* mg/l P, a cumulative OP load of 20.4 kg/yr, a potential concentration of 0.0148 mg/l P following dosing and a 'high' OP indicative water quality status following dosing. There is a significant increase in OP (i.e. 0.0023); however the increase does not breach the 75% upper status threshold and so there is no risk of a deterioration in High WFD OP status.

- Moyour_010 has a '*High*' OP indicative water quality status, a surrogate baseline concentration of *0.0125* mg/l P, a cumulative OP load of 6.5 kg/yr, a potential concentration of 0.0126 mg/l P following dosing and a 'high' OP indicative water quality status following dosing. The modelled dosing concentration is below the significance threshold (0.00125 mg/l P) and does not breach the 75% upper status threshold and there is no risk of significant deterioration in water quality for this RWB.

- Westport Bay TWB has a 'High' OP indicative water quality status, a Summer and Winter baseline concentration of 0.0075 mg/l P and 0.0125 mg/l P respectively, a cumulative OP load of 161.4 kg/yr, potential baseline concentrations following dosing of 0.0077 mg/l P (summer) and 0.0127 mg/l P (winter) and a 'high' OP indicative water quality status following dosing. The modelled dosing concentration is below the significance threshold (0.00125 mg/l P) and does not breach the 75% upper status threshold and there is no risk of significant deterioration in water quality for this TWB.

- Newport Bay TWB has a 'High' OP indicative water quality status, a Summer and Winter baseline concentration of 0.0060 mg/l P and 0.0125 mg/l P respectively, a cumulative OP load of 15.6 kg/yr, potential baseline concentrations following dosing of 0.0061 mg/l P (summer) and 0.0126 mg/l P (winter) and a 'high' OP indicative water quality status following dosing. The modelled dosing concentration is below the significance threshold (0.00125 mg/l P) and does not breach the 75% upper status threshold and there is no risk of significant deterioration in water quality for this TWB.

- Inner Clew Bay CWB has a 'High' OP indicative water quality status, a Summer and Winter baseline concentration of 0.0084 mg/l P and 0.0125 mg/l P respectively, a cumulative OP load of 177.0 kg/yr, potential baseline concentrations following dosing of 0.0085 mg/l P (summer) and 0.0126 mg/l P (winter) and a 'high' OP indicative water quality status following dosing. The modelled dosing concentration is below the significance threshold (0.00125 mg/l P) and does not breach the 75% upper status threshold and there is no risk of significant deterioration in water quality for this CWB.

The EAM assessment results which evaluate the additional OP loading from dosing at Castlebar and Sandyhill Reservoirs have demonstrated that there will be no change in the OP indicative water quality status of surface waterbodies, connected to this species in Clew Bay Complex SAC. Therefore potential for significant effects on this species can be excluded.

Furthermore, dosing will not prevent the maintenance or restoration of the favourable conservation condition of this species/ no deterioration of its favourable conservation condition is identified.

6.2.6 (1365) Harbour seal (*Phoca vitulina*)

Westport Bay contains the principal accessible moult haul-out aggregations within Clew Bay. 118 seals were counted in 2010 in Westport Bay. Attributes and targets set out by the SSCO which bear specific relevance to this project are: to conserve the breeding sites in a natural condition; to conserve the moult haul-out sites in a natural condition; to conserve the resting haul-out sites in a natural condition; and that human activities should occur at levels that do not adversely affect the harbour seal population at the site (NPWS, 2011a[13]). The orthophosphate dosing has the potential to alter the natural condition of the sites by increasing the P concentrations.

Table 3 identifies the surface waterbodies and groundwater bodies that are hydrologically or hydrogeologically connected to the proposed OP dosing and which are further connected to this species in Clew Bay Complex SAC. The EAM (**Table 3; Appendix C**) has assessed the potential for impact on OP indicative water quality status:

- Westport Bay TWB has a 'High' OP indicative water quality status, a Summer and Winter baseline concentration of 0.0075 mg/l P and 0.0125 mg/l P respectively, a cumulative OP load of 161.4 kg/yr, potential baseline concentrations following dosing of 0.0077 mg/l P (summer) and 0.0127 mg/l P (winter) and a 'high' OP indicative water quality status following dosing. The modelled dosing concentration is below the significance threshold (0.00125 mg/l P) and does not breach the 75% upper status threshold and there is no risk of significant deterioration in water quality for this TWB.

- Newport Bay TWB has a 'High' OP indicative water quality status, a Summer and Winter baseline concentration of 0.0060 mg/l P and 0.0125 mg/l P respectively, a cumulative OP load of 15.6 kg/yr, potential baseline concentrations following dosing of 0.0061 mg/l P (summer) and 0.0126 mg/l P (winter) and a 'high' OP indicative water quality status following dosing. The modelled dosing concentration is below the significance threshold (0.00125 mg/l P) and does not breach the 75% upper status threshold and there is no risk of significant deterioration in water quality for this TWB.

- Inner Clew Bay CWB has a 'High' OP indicative water quality status, a Summer and Winter baseline concentration of 0.0084 mg/l P and 0.0125 mg/l P respectively, a cumulative OP load of 177.0 kg/yr, potential baseline concentrations following dosing of 0.0085 mg/l P (summer) and 0.0126 mg/l P (winter) and a 'high' OP indicative water quality status following dosing. The modelled dosing concentration is below the significance threshold (0.00125 mg/l P) and does not breach the 75% upper status threshold and there is no risk of significant deterioration in water quality for this CWB.

The EAM assessment results which evaluate the additional OP loading from dosing at Castlebar and Sandyhill Reservoirs have demonstrated that there will be no change in the OP indicative water quality status of surface waterbodies, connected to the harbour seal in Clew Bay Complex SAC. Therefore potential for significant effects on this species can be excluded.

Furthermore, dosing will not prevent the restoration of the favourable conservation condition of this species / no deterioration of its conservation condition is identified.

6.3 NEWPORT RIVER SAC 002144

6.3.1 (1029) Freshwater pearl mussel (*Margaritifera margaritifera*) and (1106) Atlantic salmon (*Salmo salar*)

The Newport River is relatively short low-level river, flowing through wet grassland and heath from Lough Beltra to the sea at Newport, Co. Mayo. This site consists of the Newport River, Lough Beltra, and the tributaries the Skerdagh, Glenisland Crumpaun/Boghadoon and Bracklagh/Cloondaff. The C.O.s for the Newport River SAC are to maintain or restore the favourable conservation condition of the Freshwater pearl mussel and Atlantic salmon (NPWS, 2016a[19]). The Freshwater pearl mussel requires environmental conditions close to natural background levels. A 1995 survey estimated 5,000 individuals throughout the river system in both gravel and rocky bed areas. The Newport River is a renowned salmonid river and hosts Atlantic salmon. The river gets a good run of spring salmon and many large fish are caught every year. Water quality of the river is considered good, with nutrient enrichment listed as a potential threat from agricultural intensification and coniferous forestry activities (NPWS, 2013e[20]).

Table 3 identifies the surface waterbodies and groundwater bodies that are hydrologically or hydrogeologically connected to the proposed OP dosing and which are further connected to these species in Newport River SAC. The EAM (**Table 3; Appendix C**) has assessed the potential for impact on OP indicative water quality status:

- Newport (Mayo)_010 river waterbody which has High' OP indicative water quality status, a baseline concentration of 0.0072 mg/l P, a cumulative OP load of 15.6 kg/yr, a potential concentration of 0.0073 mg/l P following dosing (i.e. a modelled dosing concentration of 0.0001 mg/l P) and a 'high' OP indicative water quality status following dosing. The increase does not breach the 75% upper status threshold and the modelled increase is below the 5% significance threshold for high/ good status (i.e. 0.00125 mg/l P) therefore is no risk of significant deterioration in water quality for this RWB.

- Glenisland_010 river waterbody which has '*High*' OP indicative water quality status, a surrogate baseline concentration of *0.0125* mg/l P, a cumulative OP load of 13.6 kg/yr, a potential concentration of 0.0132 mg/l P following dosing (i.e. a modelled dosing concentration of 0.0007 mg/l P) and a 'high' OP indicative water quality status following dosing. The increase does not breach the 75% upper status threshold and the modelled increase is below the 5% significance threshold for high/ good status (i.e. 0.00125 mg/l P) therefore is no risk of significant deterioration in water quality for this RWB.

- Beltra lake waterbody which has 'Good' TP indicative water quality status, a baseline concentration of 0.0129 mg/l P, a cumulative OP load of 15.6 kg/yr, a potential concentration of 0.0130 mg/l P following dosing and a 'Good' TP indicative water quality status following dosing. The increase does not breach the 75% upper status threshold and the modelled increase is below the 5% significance threshold for high/ good status (i.e. 0.00125 mg/l P) therefore is no risk of significant deterioration in water quality for this LWB.

- Newport Bay TWB has a 'High' OP indicative water quality status, a Summer and Winter baseline concentration of 0.0060 mg/l P and 0.0125mg/l P respectively, a cumulative OP load

[19] NPWS (2016a) Conservation objectives for Newport River SAC [002144]. Generic Version 5.0. Department of Arts, Heritage, Regional, Rural and Gaeltacht Affairs.
[20] NPWS (2013e) Newport River SAC. Site Synopsis. Version date: 12.12.2013.

of 15.6 kg/yr, potential baseline concentrations following dosing of 0.0061 mg/l P (summer) and 0.0126 mg/l P (winter) and a 'high' OP indicative water quality status following dosing. The modelled dosing concentration is below the significance threshold (0.00125 mg/l P) and does not breach the 75% upper status threshold and there is no risk of significant deterioration in water quality for this TWB.

The EAM assessment results which evaluate the additional OP loading from dosing at Castlebar and Sandyhill Reservoirs have demonstrated that there will be no change in the WFD OP indicative water quality status of surface waterbodies, connected to Freshwater pearl mussels and Atlantic salmon in Newport River SAC. The modelled concentrations are below the 5% significance threshold and so there is no potential for deterioration in OP indicative water quality and although SSCOs have not been set for the Newport River SAC, results from the EAM show that restoration will not be precluded by the proposed project. Therefore potential for significant effects on these species can be excluded.

Furthermore, dosing will not prevent the maintenance or restoration of the favourable conservation condition of the habitat / no deterioration of its conservation condition is identified.

6.4 RIVER MOY SAC 002298

6.4.1 (1092) White-clawed crayfish (*Austropotamobius pallipes*)

White-clawed crayfish are widespread in the upper tributaries of the River Moy and the rivers that feed Lough Conn and Lough Cullin. It is absent from the main River Moy. A review of the targets and measures outlined in SSCO (NPWS, 2016b[21]) identified a water quality target of at least Q3-Q4 for the River Moy SAC, which equates to 'Moderate to Good' ecological status or better, therefore a reduction in water quality less than Q3-Q4 as a result of P loading would be contrary to the conservation objectives for this species.

Table 3 identifies the surface waterbodies and groundwater bodies that are hydrologically or hydrogeologically connected to the proposed OP dosing and which are further connected to white-clawed crayfish in the River Moy SAC. The EAM (**Table 3; Appendix C**) has assessed the potential for impact on OP indicative water quality:

- Clydagh (Castlebar)_010 river waterbody has 'High' OP indicative water quality status, a surrogate baseline concentration of 0.0058 mg/l P, a cumulative OP load of 17.6 kg/yr, a potential concentration of 0.0063 mg/l P following dosing and a 'high' OP indicative water quality status following dosing. The increase does not breach the 75% upper status threshold and the modelled increase is below the 5% significance threshold for high/ good status (i.e. 0.00125 mg/l P) therefore is no risk of significant deterioration in water quality for this RWB.

- Clydagh (Castlebar)_020 river waterbody has 'High' OP indicative water quality status, a baseline concentration of 0.0063 mg/l P, a cumulative OP load of 26.2 kg/yr, a potential concentration of 0.0068 mg/l P following dosing and a 'high' OP indicative water quality status following dosing. The increase does not breach the 75% upper status threshold and the modelled increase is below the 5% significance threshold for high/ good status (i.e. 0.00125 mg/l P) therefore is no risk of significant deterioration in water quality for this RWB.

[21] NPWS (2016b) Conservation Objectives: River Moy SAC 002298. Version 1. National Parks and Wildlife Service, Department of Arts, Heritage, Regional, Rural and Gaeltacht Affairs.

- Crumlin (Lough Cullin)_010 river waterbody has 'Moderate' OP indicative water quality status, a surrogate baseline concentration of *0.0455* mg/l P, a cumulative OP load of 10.0 kg/yr, a potential concentration of 0.0458 mg/l P following dosing and a 'high' OP indicative water quality status following dosing. The increase does not breach the 75% upper status threshold and the modelled increase is below the 5% significance threshold for high/ good status (i.e. 0.00125 mg/l P) therefore is no risk of significant deterioration in water quality for this RWB.

- Castlebar_020 river waterbody has 'Moderate' OP indicative water quality status, a baseline concentration of 0.0075 mg/l P, a cumulative OP load of 69.8 kg/yr, a potential concentration of 0.0082 mg/l P following dosing and a 'high' OP indicative water quality status following dosing. The increase does not breach the 75% upper status threshold and the modelled increase is below the 5% significance threshold for high/ good status (i.e. 0.00125 mg/l P) therefore is no risk of significant deterioration in water quality for this RWB.

- Castlebar_030 river waterbody has 'Moderate' OP WFD indicative water quality, a baseline concentration of 0.0125 mg/l P, a cumulative OP load of 93.0 kg/yr, a potential concentration of 0.0128 mg/l P following dosing and a 'high' OP indicative water quality status following dosing. The increase does not breach the 75% upper status threshold and the modelled increase is below the 5% significance threshold for high/ good status (i.e. 0.00125 mg/l P) therefore is no risk of significant deterioration in water quality for this RWB.

- Castlebar_040 river waterbody has 'High' OP indicative water quality status, a baseline concentration of 0.0107 mg/l P, a cumulative OP load of 119.5 kg/yr, a potential concentration of 0.0110 mg/l P following dosing and a 'high' OP indicative water quality status following dosing. The increase does not breach the 75% upper status threshold and the modelled increase is below the 5% significance threshold for high/ good status (i.e. 0.00125 mg/l P) therefore is no risk of significant deterioration in water quality for this RWB.

- Manulla_030 river waterbody has 'High' OP indicative water quality status, a baseline concentration of 0.0139 mg/l P, a cumulative OP load of 14.3 kg/yr, a potential concentration of 0.0140 mg/l P following dosing and a 'high' OP indicative water quality status following dosing. The increase does not breach the 75% upper status threshold and the modelled increase is below the 5% significance threshold for high/ good status (i.e. 0.00125 mg/l P) therefore is no risk of significant deterioration in water quality for this RWB.

- Manulla_040 river waterbody has 'High' OP indicative water quality status, a baseline concentration of 0.0116 mg/l P, a cumulative OP load of 16.5 kg/yr, a potential concentration of 0.0117 mg/l P following dosing and a 'high' OP indicative water quality status following dosing. The increase does not breach the 75% upper status threshold and the modelled increase is below the 5% significance threshold for high/ good status (i.e. 0.00125 mg/l P) therefore is no risk of significant deterioration in water quality for this RWB.

The EAM assessment results which evaluate the additional OP loading from dosing at Castlebar and Sandyhill Reservoirs have demonstrated that there will be no change in the OP indicative water quality status of groundwater or surface waterbodies, connected to white-clawed crayfish in the River Moy SAC. Therefore potential for significant effects on this species can be excluded.

Furthermore, dosing will not prevent the maintenance of the favourable conservation condition of this species / no deterioration of its favourable conservation condition is identified.

6.4.2 (1095) Sea lamprey (*Petromyzon marinus*), (1096) Brook Lamprey (*Lampetra planeri*) (1106) Atlantic salmon (*Salmo salar*)

Water quality is a particular threat to all fish fauna listed as qualifying interests. The latest Red List of Irish amphibians, reptiles & freshwater fish (King *et al.*, 2011[22]) highlights the deterioration in water quality and ongoing point and diffuse sources of pollution as a key threat to these species and includes the potential effects from municipal discharges. The SSCO (NPWS, 2016b[20]) for these fish species requires that the spawning habitat should not be reduced. A deterioration in water quality has the potential for a detrimental effect on spawning habitats, particularly where nutrient conditions result in excessive algal growth and macrophyte abundance, leading to smothering, shading effects, alteration of macroinvertebrate communities and silt deposition. The SSCO (NPWS, 2016b[20]) for salmon requires a Q value of at least 4, which equates to good ecological status.

Table 3 identifies the surface waterbodies and groundwater bodies that are hydrologically or hydrogeologically connected to the proposed OP dosing and which are further connected to the above listed fish fauna in the River Moy SAC. The EAM (**Table 3; Appendix C**) has assessed the potential for impact on OP indicative water quality:

- Clydagh (Castlebar)_010 river waterbody has 'High' OP indicative water quality status, a surrogate baseline concentration of 0.0058 mg/l P, a cumulative OP load of 17.6 kg/yr, a potential concentration of 0.0063 mg/l P following dosing and a 'high' OP indicative water quality status following dosing. The increase does not breach the 75% upper status threshold and the modelled increase is below the 5% significance threshold for high/ good status (i.e. 0.00125 mg/l P) therefore is no risk of significant deterioration in water quality for this RWB.

- Clydagh (Castlebar)_020 river waterbody has 'High' OP indicative water quality status, a baseline concentration of 0.0063 mg/l P, a cumulative OP load of 26.2 kg/yr, a potential concentration of 0.0068 mg/l P following dosing and a 'high' OP indicative water quality status following dosing. The increase does not breach the 75% upper status threshold and the modelled increase is below the 5% significance threshold for high/ good status (i.e. 0.00125 mg/l P) therefore is no risk of significant deterioration in water quality for this RWB.

- Crumlin (Lough Cullin)_010 river waterbody has 'Moderate' OP indicative water quality status, a surrogate baseline concentration of *0.0455* mg/l P, a cumulative OP load of 10.0 kg/yr, a potential concentration of 0.0458 mg/l P following dosing and a 'high' OP indicative water quality status following dosing. The increase does not breach the 75% upper status threshold and the modelled increase is below the 5% significance threshold for high/ good status (i.e. 0.00125 mg/l P) therefore is no risk of significant deterioration in water quality for this RWB.

- Castlebar_020 river waterbody has 'Moderate' OP indicative water quality status, a baseline concentration of 0.0075 mg/l P, a cumulative OP load of 69.8 kg/yr, a potential concentration of 0.0082 mg/l P following dosing and a 'high' OP indicative water quality status following dosing. The increase does not breach the 75% upper status threshold and the modelled increase is below the 5% significance threshold for high/ good status (i.e. 0.00125 mg/l P) therefore is no risk of significant deterioration in water quality for this RWB.

- Castlebar_030 river waterbody has 'Moderate' OP WFD indicative water quality, a baseline concentration of 0.0125 mg/l P, a cumulative OP load of 93.0 kg/yr, a potential concentration of 0.0128 mg/l P following dosing and a 'high' OP indicative water quality status following dosing. The increase does not breach the 75% upper status threshold and the modelled increase

[22] King, J.L., Marnell, F., Kingston, N., Rosell, R., Boylan, P., Caffrey, J.M., FitzPatrick, Ú., Gargan, P.G., Kelly, F.L., O'Grady, M.F., Poole, R., Roche, W.K. & Cassidy, D. (2011) Ireland Red List No. 5: Amphibians, Reptiles & Freshwater Fish. National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht, Dublin, Ireland.

is below the 5% significance threshold for high/ good status (i.e. 0.00125 mg/l P) therefore is no risk of significant deterioration in water quality for this RWB.

- Castlebar_040 river waterbody has 'High' OP indicative water quality status, a baseline concentration of 0.0107 mg/l P, a cumulative OP load of 119.5 kg/yr, a potential concentration of 0.0110 mg/l P following dosing and a 'high' OP indicative water quality status following dosing. The increase does not breach the 75% upper status threshold and the modelled increase is below the 5% significance threshold for high/ good status (i.e. 0.00125 mg/l P) therefore is no risk of significant deterioration in water quality for this RWB.

- Manulla_030 river waterbody has 'High' OP indicative water quality status, a baseline concentration of 0.0139 mg/l P, a cumulative OP load of 14.3 kg/yr, a potential concentration of 0.0140 mg/l P following dosing and a 'high' OP indicative water quality status following dosing. The increase does not breach the 75% upper status threshold and the modelled increase is below the 5% significance threshold for high/ good status (i.e. 0.00125 mg/l P) therefore is no risk of significant deterioration in water quality for this RWB.

- Manulla_040 river waterbody has 'High' OP indicative water quality status, a baseline concentration of 0.0116 mg/l P, a cumulative OP load of 16.5 kg/yr, a potential concentration of 0.0117 mg/l P following dosing and a 'high' OP indicative water quality status following dosing. The increase does not breach the 75% upper status threshold and the modelled increase is below the 5% significance threshold for high/ good status (i.e. 0.00125 mg/l P) therefore is no risk of significant deterioration in water quality for this RWB.

- Derryhick lake waterbody has '*High*' TP indicative water quality status, a surrogate baseline concentration of *0.0050* mg/l TP, a cumulative OP load of 10.0 kg/yr, a potential concentration of 0.0053 mg/l TP following dosing and a 'high' TP indicative water quality status following dosing. The increase does not breach the 75% upper status threshold and the modelled increase is below the 5% significance threshold for high/ good status (i.e. 0.00125 mg/l P) therefore is no risk of significant deterioration in water quality for this LWB.

- Cullin lake waterbody has 'Good' TP WFD indicative water quality status, a surrogate baseline concentration of *0.0115* mg/l TP, a cumulative OP load of 13.3 kg/yr, a potential concentration of 0.0119 mg/l TP following dosing and a 'high' TP indicative water quality status following dosing. The increase does not breach the 75% upper status threshold and there is no risk of significant deterioration in water quality for this LWB.

- Moy Estuary TWB which has a 'High' OP indicative water quality status, a baseline concentration of 0.0120 mg/l P (summer) and 0.0070 mg/l P (winter), a cumulative load of 129.4 kg/yr and baseline concentration of 0.0121 mg/l P in summer and 0.0071 mg/l P in winter following dosing. The modelled dosing concentration is below the significance threshold (0.00125 mg/l P) and does not breach the 75% upper status threshold and there is no risk of significant deterioration in water quality for this TWB.

The EAM assessment results which evaluate the additional OP loading from dosing at Castlebar and Sandyhill Reservoirs have demonstrated that there will be no change in the WFD OP indicative water quality status of groundwater or surface waterbodies, connected to salmon, brook lamprey and sea lamprey in the River Moy SAC. Therefore potential for significant effects on this species can be excluded.

Furthermore, dosing will not prevent the maintenance of the favourable conservation condition of this species / no deterioration of its favourable conservation condition is identified.

6.4.6 (1355) Otter (*Lutra lutra*)

A review of the CO (NPWS, 2016b[20]) highlighted potential habitat for Otter to include a 10m terrestrial buffer along lake shorelines and river banks as the critical area but no specific attributes or targets relating to water quality. However the National Parks & Wildlife Service's Threat Response Plan for the Otter (NPWS, 2009[16]), a review of and response to the pressures and threats to otters in Ireland, categorized three principal risks to otters: i) habitat destruction and degradation; ii) water pollution; and, iii) accidental death and/or persecution.

Table 3 identifies the surface waterbodies and groundwater bodies that are hydrologically or hydrogeologically connected to the proposed OP dosing and which are further connected to otter in the River Moy SAC. The EAM (**Table 3; Appendix C**) has assessed the potential for impact on OP indicative water quality:

- Clydagh (Castlebar)_010 river waterbody has 'High' OP indicative water quality status, a surrogate baseline concentration of 0.0058 mg/l P, a cumulative OP load of 17.6 kg/yr, a potential concentration of 0.0063 mg/l P following dosing and a 'high' OP indicative water quality status following dosing. The increase does not breach the 75% upper status threshold and the modelled increase is below the 5% significance threshold for high/ good status (i.e. 0.00125 mg/l P) therefore is no risk of significant deterioration in water quality for this RWB.

- Clydagh (Castlebar)_020 river waterbody has 'High' OP indicative water quality status, a baseline concentration of 0.0063 mg/l P, a cumulative OP load of 26.2 kg/yr, a potential concentration of 0.0068 mg/l P following dosing and a 'high' OP indicative water quality status following dosing. The increase does not breach the 75% upper status threshold and the modelled increase is below the 5% significance threshold for high/ good status (i.e. 0.00125 mg/l P) therefore is no risk of significant deterioration in water quality for this RWB.

- Crumlin (Lough Cullin)_010 river waterbody has 'Moderate' OP indicative water quality status, a surrogate baseline concentration of *0.0455* mg/l P, a cumulative OP load of 10.0 kg/yr, a potential concentration of 0.0458 mg/l P following dosing and a 'high' OP indicative water quality status following dosing. The increase does not breach the 75% upper status threshold and the modelled increase is below the 5% significance threshold for high/ good status (i.e. 0.00125 mg/l P) therefore is no risk of significant deterioration in water quality for this RWB.

- Castlebar_020 river waterbody has 'Moderate' OP indicative water quality status, a baseline concentration of 0.0075 mg/l P, a cumulative OP load of 69.8 kg/yr, a potential concentration of 0.0082 mg/l P following dosing and a 'high' OP indicative water quality status following dosing. The increase does not breach the 75% upper status threshold and the modelled increase is below the 5% significance threshold for high/ good status (i.e. 0.00125 mg/l P) therefore is no risk of significant deterioration in water quality for this RWB.

- Castlebar_030 river waterbody has 'Moderate' OP WFD indicative water quality, a baseline concentration of 0.0125 mg/l P, a cumulative OP load of 93.0 kg/yr, a potential concentration of 0.0128 mg/l P following dosing and a 'high' OP indicative water quality status following dosing. The increase does not breach the 75% upper status threshold and the modelled increase is below the 5% significance threshold for high/ good status (i.e. 0.00125 mg/l P) therefore is no risk of significant deterioration in water quality for this RWB.

- Castlebar_040 river waterbody has 'High' OP indicative water quality status, a baseline concentration of 0.0107 mg/l P, a cumulative OP load of 119.5 kg/yr, a potential concentration of 0.0110 mg/l P following dosing and a 'high' OP indicative water quality status following dosing. The increase does not breach the 75% upper status threshold and the modelled increase

is below the 5% significance threshold for high/ good status (i.e. 0.00125 mg/l P) therefore is no risk of significant deterioration in water quality for this RWB.

- Manulla_030 river waterbody has 'High' OP indicative water quality status, a baseline concentration of 0.0139 mg/l P, a cumulative OP load of 14.3 kg/yr, a potential concentration of 0.0140 mg/l P following dosing and a 'high' OP indicative water quality status following dosing. The increase does not breach the 75% upper status threshold and the modelled increase is below the 5% significance threshold for high/ good status (i.e. 0.00125 mg/l P) therefore is no risk of significant deterioration in water quality for this RWB.

- Manulla_040 river waterbody has 'High' OP indicative water quality status, a baseline concentration of 0.0116 mg/l P, a cumulative OP load of 16.5 kg/yr, a potential concentration of 0.0117 mg/l P following dosing and a 'high' OP indicative water quality status following dosing. The increase does not breach the 75% upper status threshold and the modelled increase is below the 5% significance threshold for high/ good status (i.e. 0.00125 mg/l P) therefore is no risk of significant deterioration in water quality for this RWB.

- Derryhick lake waterbody has '*High*' TP indicative water quality status, a surrogate baseline concentration of *0.0050* mg/l TP, a cumulative OP load of 10.0 kg/yr, a potential concentration of 0.0053 mg/l TP following dosing and a 'high' TP indicative water quality status following dosing. The increase does not breach the 75% upper status threshold and the modelled increase is below the 5% significance threshold for high/ good status (i.e. 0.00125 mg/l P) therefore is no risk of significant deterioration in water quality for this LWB.

- Cullin lake waterbody has 'Good' TP WFD indicative water quality status, a surrogate baseline concentration of *0.0115* mg/l TP, a cumulative OP load of 13.3 kg/yr, a potential concentration of 0.0119 mg/l TP following dosing and a 'high' TP indicative water quality status following dosing. The increase does not breach the 75% upper status threshold and there is no risk of significant deterioration in water quality for this LWB.

- Moy Estuary TWB which has a 'High' OP indicative water quality status, a baseline concentration of 0.0120 mg/l P (summer) and 0.0070 mg/l P (winter), a cumulative load of 129.4 kg/yr and baseline concentration of 0.0121 mg/l P in summer and 0.0071 mg/l P in winter following dosing. The modelled dosing concentration is below the significance threshold (0.00125 mg/l P) and does not breach the 75% upper status threshold and there is no risk of significant deterioration in water quality for this TWB.

The EAM assessment results which evaluate the additional OP loading from dosing at Castlebar and Sandyhill Reservoirs have demonstrated that there will be no change in the WFD OP indicative water quality status of groundwater or surface waterbodies, connected to otter in the River Moy SAC. Therefore potential for significant effects on this species can be excluded.

Furthermore, dosing will not prevent the maintenance of the favourable conservation condition of this species/ no deterioration of its favourable conservation condition is identified.

6.4.7 (7110) Active raised bogs*, (7120) Degraded raised bogs still capable of natural regeneration; (7150) Depressions on peat substrates of the Rhynchosporion

Raised bogs are identified at 5 locations throughout the SAC. The bogs of the River Moy SAC are examples of raised bogs at the north-western edge of its range Ombrotophic peat waters found on the surface of raised bogs are characterised by low pH values and have low values of electrical conductivity (EC). Raised bog systems mainly derives its mineral supply from precipitation, which is usually acidic and

low in nutrients. Hydrochemistry data has been reported from two of the bogs within the River Moy SAC; Derrynabrock Bog and Tawnaghbeg Bog. The hydrochemistry survey at Derrynabrock identified relatively low EC values in drains within the cutover to the south of the bog suggesting little if any mineral ground water influence. At Tawnaghbeg Bog, the hydrochemistry survey identified relatively low EC values in drains on the high bog and in drains along the east of the bog. However, more elevated EC values were recorded in the main channels draining the bog suggesting some mineral enriched groundwater influence in these channels. The SSCO target for the attribute water quality is: Water quality on the high bog and in transitional areas close to natural reference conditions (NPWS, 2016b[19]).

These bog habitats are located in upstream sections of rivers draining from the east of the SAC and so are not influenced by dosing areas on the west side of the SAC. Therefore there is no potential for significant effect on these habitats from the proposed project.

6.4.10 (7230) Alkaline fens

Alkaline fens are known to occur as part of the wetland complex on the Glore River, north-west of Ballyhaunis. However, it's likely this habitat occurs in other areas. The habitat is influenced by groundwater and surface water flows. Fens are generally poor in nitrogen and phosphorus and phosphorus is a limiting nutrient. The target identified in the SSCOs is to provide the appropriate water quality to support the natural structure and functioning of the habitat (NPWS, 2016b[19]).

Alkaline fens are located in upstream sections of rivers draining from the south east of the SAC and so are not influenced by dosing areas on the west side of the SAC. Therefore there is no potential for significant effect on this habitats from the proposed project.

6.4.11 (91E0) Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (*Alno-Padion, Alnion incanae, Salicion albae*)*

An Alluvial forest site is identified within the River Moy SAC at Prospect on the western shores of Lough Conn. However, there are likely to be more sites within the SAC. Changes in nutrient levels may result in increase to the trophic status of the wood.

Table 3 identifies the surface waterbodies and groundwater bodies that are hydrologically or hydrogeologically connected to the proposed OP dosing and which are further connected to alluvial forests habitats in the River Moy SAC. The EAM (**Table 3; Appendix C**) has assessed the potential for impact on OP indicative water quality:

- Cullin lake waterbody has 'Good' TP WFD indicative water quality status, a surrogate baseline concentration of *0.0115* mg/l TP, a cumulative OP load of 13.3 kg/yr, a potential concentration of 0.0119 mg/l TP following dosing and a 'high' TP indicative water quality status following dosing. The increase does not breach the *75%* upper status threshold and there is no risk of significant deterioration in water quality for this LWB.

The EAM assessment results which evaluate the additional OP loading from dosing at Castlebar and Sandyhill Reservoirs have demonstrated that there will be no change in the OP indicative water quality status of groundwater or surface waterbodies, connected to alluvial woodland in the River Moy SAC. Therefore potential for significant effects on this habitat can be excluded.

Furthermore, dosing will not prevent the maintenance of the favourable conservation condition of this habitat / no deterioration of its favourable conservation condition is identified.

6.5 KILLALA BAY/ MOY ESTUARY SPA 004036

The SSCOs for Killala Bay/ Moy Estuary SPA (NPWS, 2013f[23]) list targets for each species (A137) Ringed Plover (*Charadrius hiaticula*), (A140) Golden Plover (*Pluvialis apricaria*), (A141) Grey Plover (*Pluvialis squatarola*), (A144) Sanderling (*Calidris alba*), (A149) Dunlin (*Calidris alpina alpine*), (A157) Bar-tailed Godwit (*Limosa lapponica*), (A160) Curlew (*Numenius arquata*), and (A162) Redshank (*Tringa tetanus*), 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.

Furthermore, the permanent area occupied by the wetland habitat (A999 – Wetlands) should be stable and not significantly lessened, other than that occurring from natural patterns of variation.

Changes in organic and nutrient loading to an estuary may have various consequences for the ecology of the estuarine system including changes in the abundances of some benthic invertebrates that form prey species for water birds (e.g. Burton et al. 2002[24]). This could have knock-on effects upon water bird foraging distribution, prey intake rates, and ultimately upon survival and fitness.

Table 3 identifies the surface waterbodies and groundwater bodies that are hydrologically or hydrogeologically connected to the proposed OP dosing and which are further connected to these bird species in Killala Bay/ Moy Estuary SPA. The EAM (**Table 3; Appendix C**) has assessed the potential for impact on OP indicative water quality:

- Moy Estuary TWB which has a 'High' OP indicative water quality status, a baseline concentration of 0.0120 mg/l P (summer) and 0.0070 mg/l P (winter), a cumulative load of 129.4 kg/yr and baseline concentration of 0.0121 mg/l P in summer and 0.0071 mg/l P in winter following dosing. The modelled dosing concentration is below the significance threshold (0.00125 mg/l P) and does not breach the 75% upper status threshold and there is no risk of significant deterioration in water quality for this TWB.

- Killala Bay CWB which has a 'High' OP indicative water quality status, a baseline concentration of 0.0125 mg/l P (summer) and 0.0125 mg/l P (winter), a cumulative load of 129.4 kg/yr and baseline concentration of 0.0125 mg/l P in summer and 0.0125 mg/l P in winter following dosing. The modelled dosing concentration is below the significance threshold (0.00125 mg/l P) and does not breach the 75% upper status threshold and there is no risk of significant deterioration in water quality for this CWB.

The EAM assessment results which evaluate the additional OP loading from dosing at Castlebar and Sandyhill Reservoirs have demonstrated that there will be no change in the OP indicative water quality status of groundwater or surface waterbodies, connected to above listed bird species in the Killala Bay/ Moy Estuary SPA. Therefore potential for significant effects on these species can be excluded.

[23] NPWS (2013) Conservation Objectives: Killala Bay/Moy Estuary SPA 004036. Version 1. National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht.

[24] Burton, N.H.K., Paipai, E., Armitage, M.J.S., Maskell, J.M., Jones, E.T., Struve, J., Hutchings, C.J. & Rehfisch, M.M. (2002) Effects of reductions in organic and nutrient loading on bird populations in estuaries and coastal waters of England and Wales. Phase 1 Report. BTO Research Report, No. 267 to English Nature, the Countryside Council for Wales and the Environment Agency. BTO. Thetford, UK.

Furthermore, dosing will not prevent the maintenance of the favourable conservation condition of the habitats and species/ no deterioration of their favourable conservation condition is identified.

6.6 LOUGH CONN AND LOUGH CULLIN SPA 004228

The SSCOs for Lough Conn and Lough Cullin SPA (NPWS, 2016c[25]) are: to maintain or restore the favourable conservation condition of the bird species (A061) Tufted Duck (*Aythya fuligula*), (A065) Common Scoter (*Melanitta nigra*), (A182) Common Gull (*Larus canus*), and (A395) Greenland White-fronted Goose (*Anser albifrons flavirostris*); and to maintain or restore the favourable conservation condition of the wetland habitat at Lough Conn and Lough Cullin SPA as a resource for the regularly-occurring migratory waterbirds that utilise it. Lough Conn and Cullin breeding scoter populations reportedly collapsed over a 27 year period, owing to the doubling of total phosphorus between 1980 and 1990 resulting in filamentous algae blooms and the subsequent changes in fish population structure (Hunt *et al.*, 2013[26]).

Table 3 identifies the surface waterbodies and groundwater bodies that are hydrologically or hydrogeologically connected to the proposed OP dosing and which are further connected to these bird species in Killala Bay/ Moy Estuary SPA. The EAM (**Table 3; Appendix C**) has assessed the potential for impact on OP indicative water quality:

- Cullin lake waterbody has 'Good' TP WFD indicative water quality status, a surrogate baseline concentration of *0.0115* mg/l TP, a cumulative OP load of 13.3 kg/yr, a potential concentration of 0.0119 mg/l TP following dosing and a 'high' TP indicative water quality status following dosing. The increase does not breach the *75%* upper status threshold and there is no risk of significant deterioration in water quality for this LWB.

The EAM assessment results which evaluate the additional OP loading from dosing at Castlebar and Sandyhill Reservoirs have demonstrated that there will be no change in the WFD TP indicative water quality status of groundwater or surface waterbodies, connected to above listed bird species and wetland habitat in the Lough Conn and Lough Cullin SPA. Therefore potential for significant effects on these species can be excluded.

Furthermore, dosing will not prevent the maintenance of the favourable conservation condition of the wetland habitat and bird species/ no deterioration of their favourable conservation condition is identified.

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

In order to ensure all potential effects upon European sites within the project's ZoI were considered, including those direct and indirect impact pathways that are a result of cumulative or in-combination effects, 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;

[25] NPWS (2016c) Conservation objectives for Lough Conn and Lough Cullin SPA [004228]. Generic Version 5.0. Department of Arts, Heritage, Regional, Rural and Gaeltacht Affairs.
[26] Hunt, J., Heffernan, M.L., McLoughlin, D., Benson, C. & Huxley, C. (2013) The breeding status of Common Scoter, *Melanitta nigra* in Ireland, 2012. Irish Wildlife Manuals, No. 66. National Parks and Wildlife Service, Department of the Arts, Heritage and the Gaeltacht, Ireland.

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 effects are likely to be significant.

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

Based on this search and the Project Teams knowledge of the study area a list of those projects and Plans which may potentially contribute to cumulative or in-combination effects with the proposed OP dosing project was generated and listed in **Table 5** below.

Table 5: In-Combination Impacts with Other Plans, Programmes and Policies

Plan / Programme/Policy	Key Types of Impacts	Potential for In-combination Effects
Mayo County Council Development Plan 2014 – 2020 (Incorporating variation No. 1 made on the 13th of July 2015 and No. 2 made on the 16th of January 2017) The policies, objectives and zonings of relevance in the Mayo County Development Plan include under Infrastructure and Water Services: WS-01 It is an objective of the Council to ensure the provision of an adequate level of water services infrastructure throughout the County to meet domestic, commercial, industrial and other needs, having regard to the Core Strategy and Settlement Strategy of this Plan, the Water Services Investment Programme, the Rural Water Programme and Table 3 above and where it can be demonstrated that the development will not have significant adverse effects on the environment including the integrity of the Natura 2000 network. WS-02 It is an objective of the Council to ensure a safe and secure water supply is provided in the County. WS-04 It is an objective of the Council to ensure that water services requirements of all new developments will not exceed existing water services infrastructural capacity available unless additional capacity is provided. Under Environment, Heritage & Amenity Strategy and Water Quality: WQ-01 It is an objective of the Council to implement the Western River Basin District Management Plan "Water Matters" 2009-2015 to ensure the protection, restoration and sustainable use of all waters in the County, including rivers, lakes, ground water, coastal and transitional waters, and to restrict development likely to lead to deterioration in water quality or quantity. WQ-02 It is an objective of the Council to require development in an unsewered area which includes a septic tank/proprietary effluent treatment unit and percolation area to be rigorously assessed in accordance with the accepted EPA Code of Practice for single houses or small communities, business, leisure centres and hotels, taking into account the cumulative effects of existing and proposed developments in the area. Any planning applications for development which require such systems shall be accompanied with an assessment carried out and certified by a suitably qualified person (i.e. the holder of an EPA FETAC certificate or equivalent) with professional indemnity insurance. WQ-03 It is an objective of the Council to require any new development to connect to a public water supply or Group Water Scheme. Connections to wells for individual	▪ N/A	The Mayo County Council Development Plan 2014 – 2020 emphasises the objectives of its water services which include enhancement and improved quality of the service to its customers. The plan also outlines the importance of compliance with the Western River Basin Management Plan (now replaced by the National Plan 2018-2011[27]), and emphasises compliance with environmental objectives. There is no potential for cumulative effects with these plans.

[27] DHPLG (2016) Public Consultation on the River Basin Management Plan for Ireland (2018-2021)

housing units in unserviced rural areas will only be considered where there is no public water main or Group Water Scheme serving the site and where it can be demonstrated that connection to the proposed well will not have significant adverse effects on water quality or water quantity in the area and can provide a potable water supply in accordance with EU Drinking Water standards.		
River Basin Management Plan For Ireland 2018 – 2021 Public Consultation on the River Basin Management Plan (RBMP) for Ireland (2018 – 2021), began in February 2017. The document (Chapter 4) sets out the condition of Irish waters, and a summary of statuses for all monitored waters in the 2013 – 2015 period, including a description of the changes since 2007 – 2009. Nationally, both monitored river waterbodies and lakes at 'high' or 'good' ecological status, appear to have declined by 3% since 2007 – 2009; nevertheless, this figure does not reflect a significant number of improvements and dis-improvements across these waters since 2009. Provisional figures from the EPA suggest that approximately 900 river waterbodies and lakes have either improved or dis-improved. In addition, the previously observed long term trend of decline in the number of high status river sites has continued. Chapter 5 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 2021. This work was presented in the RBMP for 81% of water bodies nationally, which had been characterised at the time. 1,517 waterbodies were classed *At Risk* out of a total of 4,775, or 32%. An assessment of significant environmental pressures found that agriculture was the most significant pressure in 729 river and lake water bodies that are *At Risk*. Urban waste water, hydromorphology and forestry were also significant pressures amongst others.	▪ N/A	The objectives of the RBMP are to: ▪ Prevent deterioration; ▪ Restore good status; ▪ Reduce chemical pollution; and ▪ Achieve water related protected areas objectives. The implementation of the RBMP seeks compliance with the environmental objectives set under the plan, which will be documented for each waterbody. 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.
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	▪ Habitat loss or destruction; ▪ Habitat fragmentation or degradation; ▪ Alterations to water quality and/or water movement; ▪ Disturbance; and	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

rolled out and Draft Flood Risk Management Plans have been prepared. These plans have been subject AA.	▪ In-combination impacts within the same scheme	of the plans will need to consider the potential for impacts from hard engineering solutions and how they might affect hydrological connectivity and hydromorphological supporting conditions for protected habitats and species. There is no potential for cumulative effects 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; and ▪ Disturbance to habitats / species	Foodwise 2025 was subject to its own AA[28]. 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 effects 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	▪ Overgrazing; ▪ Land use change or intensification; ▪ Water pollution; ▪ Nitrogen deposition; and ▪ Disturbance to habitats / species;	The RDP for 2014 – 2020 has been subject to SEA[29], and AA[30]. 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

[28] http://www.agriculture.gov.ie/media/migration/foodindustrydevelopmenttrademarkets/agri-foodandtheeconomy/foodwise2025/environmentalanalysis/AgriFoodStrategy2025NISDRAFT300615.pdf

[29] https://www.agriculture.gov.ie/media/migration/ruralenvironment/ruraldevelopment/ruraldevelopmentprogramme2014-2020/StrategEnvironmAssessSumState090615.pdf

[30] https://www.agriculture.gov.ie/media/migration/agarchive/ruralenvironment/preparatoryworkfortherdp2014-2020/RDP20142020DraftAppropriateAssessmentReport160514.pdf

supportive measure to improve water quality and thus provide direct benefits in achieving the measures within the RBMP. The achievement of the objectives outlined within GLAS, to improve water quality, mitigate against climate change and promote biodiversity will be of direct positive benefit in achieving the measures within the RBMP and the goals of the Natura Directives. The scheme has an expected participation for 2014-2020 of 50,000 farmers which have to engage in specific training and tasks in order to receive full payment. Farmers within the scheme must have a nutrient management plan which is a strategy for maximising the return from on and off-farm chemical and organic fertilizer resources. This has a direct positive contribution towards protecting waterbodies from pollution through limiting the amount of fertiliser that is placed on the land. The scheme prioritises farms in vulnerable catchments with 'high status' waterbodies 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.		effects of RDP measures. With such measures in place, it was concluded that there would be no significant in-combination effects 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 regulations. It is spread across six catchments and encompasses approximately 300 farmers.	▪ Land use change or intensification; ▪ Water pollution; ▪ Nitrogen deposition; and ▪ 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[31]. It concluded that the NAP was an environmental programme which imposes environmental constraints on all agricultural systems in the state. It therefore benefits Natura 2000 sites and their species. In terms of in-combination effects, it stated that the Food Wise 2025 strategy would have to operate within the constraints of the NAP.
Forest Policy Review: Forests, Products and People – A Renewed Vision (2014) / Forestry Programme 2014 - 2020	▪ Habitat loss or destruction;	Ireland's Forestry Programme 2014 – 2020 has undergone AA[32]. A key recommendation is that all

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

[32] https://www.agriculture.gov.ie/media/migration/forestry/publicconsultation/newforestryprogramme2014-2020/nis/ForestryProgrammeNaturaImpactStatement290914.pdf

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 fragmentation or degradation; ▪ Water quality changes; and ▪ Disturbance to species.	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 effects with the proposed project.
Water Services Strategic Plan (WSSP, 2015) Irish Water 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 Irish Water prepare and it sets the overarching framework for subsequent detailed implementation plans (Tier 2) and water services projects (Tier 3). The WSSP sets out the challenges we face as a country in relation to the provision of water services and identifies strategic national priorities. It includes Irish Water'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 Irish Water 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 Irish Water owned asset and this is a significant piece of the puzzle in terms of the expected improvements from the RBMP.	▪ Habitat loss and disturbance from new / upgraded infrastructure; ▪ Species disturbance; ▪ Changes to water quality or quantity; and ▪ Nutrient enrichment /eutrophication.	The overarching strategy was subject to AA and highlighted the need for additional plan/project environmental assessments to be carried out at the tier 2 and tier 3 level. Therefore, no likely significant in-combination effects are envisaged.
National Wastewater Sludge Management Plan (2016)	▪ Habitat loss and disturbance from	The plan was subject to both AA and SEA and includes a number of mitigation measures which were identified in

The National Wastewater Sludge Management Plan was prepared in 2015, outlining the measures needed to improve the management of wastewater sludge.	new / upgraded infrastructure; ▪ Species disturbance; ▪ Changes to water quality or quantity; and ▪ Nutrient enrichment /eutrophication.	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 Irish Water facilities. In relation to the plan as it stands, no in-combination effects are expected with the implementation of proposed mitigation measures.
Lead Mitigation Plan (2016) Included in the WSSP (2015) is the strategy WS1e – Prepare and implement a "Lead in Drinking Water Mitigation Plan" to effectively address the risk of failure to comply with the drinking water quality standard for lead due to lead pipework. This strategy has been realised in the 2016 Lead Mitigation Plan.	▪ Changes to water quality or quantity; and ▪ Nutrient enrichment /eutrophication.	The plan is subject to SEA and AA which have also been published and are available at http://www.water.ie. There are no OP dosing areas upstream of Lough Mask RWSS and the cumulative effect of dosing in Castlebar and Sandyhill Reservoirs along with downstream dosing areas has been taken into account in the EAM s for any downstream catchments and will subsequently be dealt with in relevant reporting to inform AA for those projects.

7. SCREENING CONCLUSION STATEMENT

This Screening for AA has considered the potential for significant effects on European Sites arising from the proposed orthophosphate dosing at the Castlebar and Sandyhill Reservoirs, within the Lough Mask RWSS and the ZOI. The potential for significant effects are evaluated with regard to the qualifying interests/species of conservation interests and associated conservation status.

The potential for direct, indirect and cumulative impacts affecting (Killala Bay/ Moy Estuary SAC (000458), Clew Bay Complex SAC (001482), Newport River SAC (002144), River Moy SAC (002298), Killala Bay/ Moy Estuary SPA (004036) and Lough Conn and Lough Cullin SPA (004228) has been assessed. The appraisal undertaken in this Screening report has been informed by an EAM (see **Appendix C**) with reference to the ecological communities and habitats. The Screening for AA has determined that there is not potential for significant direct, indirect or cumulative impacts which could affect the qualifying interests/special conservation interests of the European sites within the study area. It is therefore concluded, beyond reasonable scientific doubt, that the proposed project will not give rise to significant effects, either individually or in combination with other plans and projects, within the identified European Site(s).

On the basis of objective scientific information, this Screening has therefore excluded the potential for the proposed project, individually or in combination with other plans or projects, to give rise to any significant effect on a European Site. It is concluded that an AA is therefore not required.

8. REFERENCES

Burton, N.H.K., Paipai, E., Armitage, M.J.S., Maskell, J.M., Jones, E.T., Struve, J., Hutchings, C.J. & Rehfisch, M.M. (2002) Effects of reductions in organic and nutrient loading on bird populations in estuaries and coastal waters of England and Wales. Phase 1 Report. BTO Research Report, No. 267 to English Nature, the Countryside Council for Wales and the Environment Agency. BTO. Thetford, UK.

Council Directive 2009/147/ EC on the Conservation of Wild Birds.

Council Directive 92/43/EEC on the Conservation of Natural Habitats and of Wild Fauna and Flora.

DCHG (2017). National Biodiversity Action Plan 2017 – 2021. Produced by the National Parks and Wildlife Service, Department of the

DEHLG (2010). Appropriate Assessment of Plans and Projects in Ireland – Guidance for Planning Authorities. Produced by the National Parks and Wildlife Service, Department of the Environment, Heritage and Local Government, Dublin.

DECLG (2015). National Strategy to reduce exposure to Lead in Drinking Water. http://www.housing.gov.ie/sites/default/files/migrated-files/en/Publications/Environment/Water/FileDownLoad%2C41733%2Cen.pdf

Environment Agency (2006). Use and design of oil separators in surface water drainage systems: PPG 3.https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/290142/pmho0406biyl-e-e.pdf.

EPA (2010) Methodology for establishing groundwater threshold values and the assessment of chemical and quantitative status of groundwater, including an assessment of pollution trends and trend reversal. 57 pp.

http://www.epa.ie/pubs/reports/water/ground/Methodology%20for%20Groundwater%20Chemical%20&%20Quantitative%20Status%20Methology,%20TVs%20and%20Trends.pdf

European Commission (2000a) Communication from the Commission on the Precautionary Principle, Office for Official Publications of the European Communities, Luxembourg.

European Commission (2000b). Managing Natura 2000 Sites: the provisions of Article 6 of the 'Habitats' Directive 92/43/EEC. Office for Official Publications of the European Communities, Luxembourg.

European Commission (2002). 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. Office for Official Publications of the European Communities, Luxembourg.

European Commission (2011). Guidelines on the Implementation of the Birds and Habitats Directives in Estuaries and Coastal Zones, with particular attention to port development and dredging. European Communities (Natural Habitats) Regulations (S.I. No. 477 of 2011)

European Communities (Birds and Natural Habitats) Regulations 2011 to 2015

European Union (Drinking Water) Regulations 2014

Hunt, J., Heffernan, M.L., McLoughlin, D., Benson, C. & Huxley, C. (2013) The breeding status of Common Scoter, *Melanitta nigra* in Ireland, 2012. Irish Wildlife Manuals, No. 66. National Parks and Wildlife Service, Department of the Arts, Heritage and the Gaeltacht, Ireland.

Irish Water (IW) (2016) Lead in Drinking Water Mitigation Plan. https://www.water.ie/projects-plans/lead-mitigation-plan/Lead-in-Drinking-Water-Mitigation-Plan.pdf

Killeen, I., Moorkens, E. & Seddon, M.B.2011. *Vertigo geyeri*. The IUCN Red List of Threatened Species 2011: e.T22940A9400082. http://dx.doi.org/10.2305/IUCN.UK.2011-2.RLTS.T22940A9400082.en.

King, J.L.; Marnell, F.; Kingston, N.; Rosell, R.; Boylan, P.; Caffrey, J.M.; FitzPatrick, Ú.; Gargan, P.G.; Kelly, F.L.; O'Grady, M.F.; Poole, R.; Roche, W.K.; Cassidy, D. (2011). Red Lists Ireland Red List No. 5: Amphibians, Reptiles & Freshwater Fish. National Parks and Wildlife Service, Department of the Environment, Heritage and Local Government, Dublin, Ireland.

Moorkens, E., Killeen, I., Seddon, M. (2012). Vertigo angustior. The IUCN Red List of Threatened Species 2012: e.T22935A16658012.

NPWS (2009) Threat response plan: Otter (2009 - 2011). National Parks and Wildlife Service, Department of the Environment, Heritage and Local Government, Dublin, Ireland.

NPWS (2011) Conservation Objectives: Clew Bay Complex SAC 001482. Version 1.0. National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht.

NPWS (2011) Clew Bay Complex SAC (site code: 1482). Conservation objectives supporting document –marine habitats Version 1.

NPWS (2012a) Conservation Objectives: Killala Bay/Moy Estuary SAC 000458. Version 1.0. National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht.

NPWS (2012b) Killala Bay/ Moy Estuary SAC (site code: 458). Conservation objectives supporting document –coastal habitats Version 1.

NPWS (2013a) Article 17 Overview Report (Vol. 1) The Status of EU Protected Habitats and Species in Ireland.

NPWS (2013b) Article 17 Habitat Conservation Assessments (Vol. 2) Version 1.1. The Status of EU Protected Habitats and Species in Ireland.

NPWS (2013c) Article 17 Species Conservation Assessments (Vol. 3) Version 1.1. The Status of EU Protected Habitats and Species in Ireland.

NPWS (2013) Ireland's Summary Report for the period 2008 – 2012 under Article 12 of the Birds Directive. https://circabc.europa.eu/sd/a/a211d525-ff4d-44f5-a360-e82c6b4d3367/IE_A12NatSum_20141031.pdf

NPWS (2013e) Newport River SAC. Site Synopsis. Version date: 12.12.2013.

NPWS (2013f) Conservation Objectives: Killala Bay/Moy Estuary SPA 004036. Version 1. National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht.

NPWS (2015) Water Framework Directive Annex IV Protected Areas: Water Dependent Habitats and Species and High Status Sites.

NPWS (2016a) Conservation objectives for Newport River SAC [002144]. Generic Version 5.0. Department of Arts, Heritage, Regional, Rural and Gaeltacht Affairs.

NPWS (2016b) Conservation Objectives: River Moy SAC 002298. Version 1. National Parks and Wildlife Service, Department of Arts, Heritage, Regional, Rural and Gaeltacht Affairs.

NPWS (2016c) Conservation objectives for Lough Conn and Lough Cullin SPA [004228]. Generic Version 5.0. Department of Arts, Heritage, Regional, Rural and Gaeltacht Affairs. Planning and Development Act 2000 (as amended).

UKTAG (2009) Reporting confidence in groundwater status assessments. 4pp.

http://www.wfduk.org/resources%20/reporting-confidence-groundwater-status-ssessments

Appendix A

European Sites - Conservation Objectives

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Conservation Objectives Series

Killala Bay/Moy Estuary SAC 000458

An Roinn
Ealaíon, Oidhreachta agus Gaeltachta
Department of
Arts, Heritage and the Gaeltacht

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Introduction

The overall aim of the Habitats Directive is to maintain or restore the favourable conservation status of habitats and species of community interest. These habitats and species are listed in the Habitats and Birds Directives and Special Areas of Conservation and Special Protection Areas are designated to afford protection to the most vulnerable of them. These two designations are collectively known as the Natura 2000 network.

European and national legislation places a collective obligation on Ireland and its citizens to maintain habitats and species in the Natura 2000 network at favourable conservation condition. The Government and its agencies are responsible for the implementation and enforcement of regulations that will ensure the ecological integrity of these sites.

A site-specific conservation objective aims to define favourable conservation condition for a particular habitat or species at that site.

The maintenance of habitats and species within Natura 2000 sites at favourable conservation condition will contribute to the overall maintenance of favourable conservation status of those habitats and species at a national level.

Favourable conservation status of a habitat is achieved when:

- its natural range, and area it covers within that range, are stable or increasing, and
- 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.

The 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, and
- 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.

Notes/Guidelines:

1. The targets given in these conservation objectives are based on best available information at the time of writing. As more information becomes available, targets for attributes may change. These will be updated periodically, as necessary.
2. An appropriate assessment based on these conservation objectives will remain valid even if the targets are subsequently updated, providing they were the most recent objectives available when the assessment was carried out. It is essential that the date and version are included when objectives are cited.
3. Assessments cannot consider an attribute in isolation from the others listed for that habitat or species, or for other habitats and species listed for that site. A plan or project with an apparently small impact on one attribute may have a significant impact on another.
4. Please note that the maps included in this document do not necessarily show the entire extent of the habitats and species for which the site is listed. This should be borne in mind when appropriate assessments are being carried out.
5. When using these objectives, it is essential that the relevant backing/supporting documents are consulted, particularly where instructed in the targets or notes for a particular attribute.

Qualifying Interests

**** indicates a priority habitat under the Habitats Directive***

000458	Killala Bay/Moy Estuary SAC
1014	Narrow-mouthed Whorl Snail *Vertigo angustior*
1095	Sea Lamprey *Petromyzon marinus*
1130	Estuaries
1140	Mudflats and sandflats not covered by seawater at low tide
1210	Annual vegetation of drift lines
1310	Salicornia and other annuals colonizing mud and sand
1330	Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*)
1365	Harbour Seal *Phoca vitulina*
2110	Embryonic shifting dunes
2120	Shifting dunes along the shoreline with *Ammophila arenaria* ('white dunes')
2130	*Fixed coastal dunes with herbaceous vegetation ('grey dunes')
2190	Humid dune slacks

Please note that this SAC overlaps with Killala Bay/Moy Estuary SPA (004036) and is adjacent to River Moy SAC (002298). See map 2. The conservation objectives for this site should be used in conjunction with those for the overlapping and adjacent sites as appropriate.

Supporting documents, relevant reports & publications (listed by date)

Supporting documents, NPWS reports and publications are available for download from: www.npws.ie/Publications

Title: Harbour seal pilot monitoring project, 2011
Year: 2012
Author: NPWS
Series: Unpublished Report to NPWS

Title: Killala Bay/Moy Estuary SAC (000458). Conservation objectives supporting document - marine habitats and species. [Version 1]
Year: 2012
Author: NPWS
Series: Unpublished Report to NPWS

Title: Killala Bay/Moy Estuary SAC (000458). Conservation objectives supporting document - coastal habitats. [Version 1]
Year: 2012
Author: NPWS
Series: Unpublished Report to NPWS

Title: Subtidal Benthic Investigations in Killala Bay/Moy Estuary cSAC (Site Code: IE000458) Co. Sligo/Mayo
Year: 2011
Author: Aquafact
Series: Unpublished Report to NPWS & MI

Title: A survey of mudflats and sandflats in Ireland An intertidal soft sediment survey of Killala Bay
Year: 2011
Author: ASU
Series: Unpublished Report to NPWS & MI

Title: Monitoring and Condition Assessment of Populations of *Vertigo geyeri*, *Vertigo angustior* and *Vertigo moulinsiana* in Ireland
Year: 2011
Author: Moorkens, E.A.; Killeen, I.J.
Series: Irish Wildlife Manuals, No. 55

Title: Harbour seal pilot monitoring project, 2010
Year: 2011
Author: NPWS
Series: Unpublished Report to NPWS

Title: Harbour seal population monitoring 2009-2012: Report no. 1. Report on a pilot monitoring study carried out in southern and western Ireland, 2009
Year: 2010
Author: NPWS
Series: Unpublished Report to NPWS

Title: Saltmarsh Monitoring Report 2007-2008
Year: 2009
Author: McCorry, M.; Ryle, T.
Series: Unpublished Report to NPWS

Title: Coastal Monitoring Project 2004-2006

Year: 2009

Author: Ryle, T.; Murray, A.; Connolly, C.; Swann, M.

Series: Unpublished Report to NPWS

Title: The phytosociology and conservation value of Irish sand dunes

Year: 2008

Author: Gaynor, K.

Series: Unpublished PhD thesis, National University of Ireland, Dublin

---

Title: Saltmarsh Monitoring Report 2006

Year: 2007

Author: McCorry, M.

Series: Unpublished Report to NPWS

Title: A Survey of Juvenile Lamprey Populations in the Corrib and Suir Catchments

Year: 2007

Author: O'Connor, W.

Series: Irish Wildlife Manuals No. 26

Title: Harbour seal population assessment in the Republic of Ireland: August 2003

Year: 2004

Author: Cronin, M.; Duck, C.; Ó Cadhla, O.; Nairn, R.; Strong, D.; O'Keeffe, C.

Series: Irish Wildlife Manuals No. 11

Title: Summary of National Parks & Wildlife Service surveys for common (harbour) seals (*Phoca vitulina*) and grey seals (*Halichoerus grypus*), 1978 to 2003

Year: 2004

Author: Lyons, D.O.

Series: Irish Wildlife Manuals No. 13

Title: A survey of juvenile lamprey populations in the Moy catchment

Year: 2004

Author: O'Connor, W.

Series: Irish Wildlife Manuals No. 15

Title: Monitoring the river, sea and brook lamprey, *Lampetra fluviatilis*, *L. planeri* and *Petromyzon marinus*

Year: 2003

Author: Harvey, J.; Cowx, I.

Series: Conserving Natura 2000 Rivers Monitoring Series No. 5. English Nature, Peterborough

---

Title: A survey of bottlenose dolphins (*Tursiops truncatus*) in the Shannon Estuary

Year: 2000

Author: Rogan, E.; Ingram, S.; Holmes, B.; O'Flanagan, C.

Series: Marine Institute Marine Resource Series No. 9

Title: 1989 survey of breeding herds of common seal *Phoca vitulina* with reference to previous surveys

Year: 1990

Author: Harrington, R.

Series: Unpublished Report to Wildlife Service

Title: An assessment of the status of the common seal *Phoca vitulina vitulina* in Ireland

Year: 1980

Author: Summers, C.F.; Warner, P.J; Nairn, R.G.W.; Curry, M.G.; Flynn, J.

Series: Biological Conservation 17: 115-123

Spatial data sources

Year:	2010
Title:	EPA WFD transitional waterbody data
GIS operations:	Clipped to SAC boundary. Expert opinion used as necessary to resolve any issues arising
Used for:	1130 (map 3)
Year:	Interpolated 2012
Title:	Mudflat and sandflat survey 2010; subtidal benthic survey 2010
GIS operations:	Polygon feature classes from marine community types base data sub-divided based on interpolation of marine survey data. Expert opinion used as necessary to resolve any issues arising
Used for:	Marine community types, 1140 (maps 4 and 5)
Year:	2005
Title:	OSi Discovery series vector data
GIS operations:	High water mark (HWM) and low water mark (LWM) polyline feature classes converted into polygon feature classes and combined; EU Annex I Saltmarsh and Coastal data erased out if present
Used for:	Marine community types base data (map 5)
Year:	Revision 2010
Title:	Saltmarsh Monitoring Project 2007-2008. Version 1
GIS operations:	QIs selected; clipped to SAC boundary; overlapping regions with Coastal CO data investigated and resolved with expert opinion used
Used for:	1310, 1330 (map 6)
Year:	2009
Title:	Coastal Monitoring Project 2004-2006. Version 1
GIS operations:	QIs selected; clipped to SAC boundary; overlapping regions with Saltmarsh CO data investigated and resolved with expert opinion used
Used for:	1210, 2110, 2120, 2130, 2190 (map 7)
Year:	2012
Title:	NPWS rare and threatened species database
GIS operations:	Dataset created from spatial references in database records. Expert opinion used as necessary to resolve any issues arising
Used for:	1014, 1365 (maps 8 and 9)
Year:	2005
Title:	OSi Discovery series vector data
GIS operations:	High Water Mark (HWM) polyline feature class converted into polygon feature class; clipped to SAC boundary. Expert opinion used as necessary to resolve any issues arising
Used for:	1365 (map 9)

1014 Narrow-mouthed Whorl Snail *Vertigo angustior*

To maintain the favourable conservation condition of Narrow-mouthed Whorl Snail in Killala Bay/Moy Estuary SAC, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Distribution: occupied sites	Number	No decline. There is one known site for this species in this SAC. See map 8	From Moorkens and Killeen (2011)
Presence on transect	Occurrence	Adult or sub-adult snails are present in at least 3 places on the transect where optimal or sub-optimal habitat occurs (minimum 5 samples)	Transect established as part of condition assessment monitoring at this site (Moorkens and Killeen, 2011). See habitat area target below for definition of optimal and sub-optimal habitat
Abundance	Number per sample	At least 2 samples on the transect have more than 10 *V. angustior* individuals (minimum 5 samples)	From Moorkens and Killeen (2011)
Transect habitat quality	Metres	More than 50m of habitat along the transect is classed as optimal or sub-optimal	From Moorkens and Killeen (2011). See habitat area target below for definition of optimal and sub-optimal habitat
Transect optimal wetness	Metres	Soils, at time of sampling, are damp (optimal wetness) and covered with a layer of humid thatch for more than 50m along the transect	From Moorkens and Killeen (2011)
Habitat area	Hectares	1.465ha of potential habitat (optimal and sub-optimal); Optimal habitat is defined as marsh with transition of ecotone between red fescue (*Festuca rubra*) and silverweed (*Potentilla anserina*) wet grassland and waterlogged marsh dominated by yellow iris (*Iris pseudacorus*) and low growing herbs. Vegetation height 20-40cm. Habitat growing on wet to saturated soil covered with a deep layer of mosses and humid, open structured thatch. Sub-optimal habitat is defined as for optimal habitat, but either vegetation height is less than 20cm, or between 40 and 50cm; or the soil is dry, or covered with standing water	From Moorkens and Killeen (2011)

1095 Sea Lamprey *Petromyzon marinus*

To maintain the favourable conservation condition of Sea Lamprey in Killala Bay/Moy Estuary SAC, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Distribution: extent of anadromy	% of estuary accessible	No barriers for migratory life stages of lamprey moving from freshwater to marine habitats and vice versa	This SAC only covers the estuarine portion of the River Moy. The adjacent River Moy SAC (site code: 2298) encompasses the freshwater elements of sea lamprey habitat. Artificial barriers can block or cause difficulties to lampreys' upstream migration, thereby limiting species to lower stretches and restricting access to spawning areas. See O'Connor (2004) for further information on artificial barriers in the Moy catchment
Population structure of juveniles	Number of age/size groups	At least three age/size groups present	Attribute and target based on data from Harvey and Cowx (2003) and O'Connor (2007). Important juvenile habitat identified immediately downstream of Ballina (see O'Connor, 2004)
Juvenile density in fine sediment	Juveniles/m²	Juvenile density at least 1/m²	Juveniles burrow in areas of fine sediment in still water. Attribute and target based on data from Harvey and Cowx (2003). Important juvenile habitat identified immediately downstream of Ballina (see O'Connor, 2004)

1130 Estuaries

To maintain the favourable conservation condition of Estuaries in Killala Bay/Moy Estuary SAC, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Habitat area	Hectares	The permanent habitat area is stable or increasing, subject to natural processes. See map 3	Habitat area was estimated as 736ha using OSi data and the defined Transitional Water Body area under the Water Framework Directive
Community extent	Hectares	Maintain the extent of the *Zostera*-dominated community, subject to natural processes. See map 5	Estimated by EPA during 2011 intertidal survey. See marine supporting document for further details
Community structure: *Zostera* density	Shoots per m^2	Conserve the high quality of the *Zostera*-dominated community, subject to natural processes	Estimated by EPA during 2011 intertidal survey. See marine supporting document for further details
Community distribution	Hectares	Conserve the following community types in a natural condition: Muddy sand to fine sand dominated by *Hydrobia ulvae*, *Pygospio elegans* and *Tubificoides benedii* community complex; Estuarine muddy sand dominated by *Hediste diversicolor* and *Heterochaeta costata* community complex; and Fine sand dominated by *Nephtys cirrosa* community complex. See map 5	Habitat structure was elucidated from intertidal and subtidal surveys undertaken in 2010 (Aquafact, 2011; ASU, 2011). See marine supporting document for further details

1140 Mudflats and sandflats not covered by seawater at low tide

To maintain the favourable conservation condition of Mudflats and sandflats not covered by seawater at low tide in Killala Bay/Moy Estuary SAC, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Habitat area	Hectares	The permanent habitat area is stable or increasing, subject to natural processes. See map 4	Habitat area was estimated as 1,332ha using OSi data
Community extent	Hectares	Maintain the extent of the *Zostera*-dominated community, subject to natural processes. See map 5	Estimated by EPA during 2011 intertidal survey. See marine supporting document for further details
Community structure: *Zostera* density	Shoots per m²	Conserve the high quality of the *Zostera*-dominated community, subject to natural processes	Estimated by EPA during 2011 intertidal survey. See marine supporting document for further details
Community distribution	Hectares	Conserve the following community types in a natural condition: Muddy sand to fine sand dominated by *Hydrobia ulvae, Pygospio elegans* and *Tubificoides benedii* community complex; Estuarine muddy sand dominated by *Hediste diversicolor* and *Heterochaeta costata* community complex and Fine sand dominated by *Nephtys cirrosa* community complex. See map 5	Habitat structure was elucidated from intertidal survey undertaken in 2010 (ASU, 2011). See marine supporting document for further details

1210 Annual vegetation of drift lines

To maintain the favourable conservation condition of Annual vegetation of drift lines in Killala Bay/Moy Estuary SAC, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Habitat area	Hectares	Area stable or increasing, subject to natural processes, including erosion and succession. For sub-site mapped: Bartragh Island-0.58ha. See map 7	Based on data from the Coastal Monitoring Project (Ryle et al. 2009). Habitat is very difficult to measure in view of its dynamic nature which means that it can appear and disappear within a site from year to year. This habitat was only recorded from Bartragh Island. See coastal habitats supporting document for further details
Habitat distribution	Occurrence	No decline, or change in habitat distribution, subject to natural processes	Based on data from Ryle et al. (2009). Two separate narrow strips of strandline habitat were recorded on the northern side of Bartragh Island. See coastal habitats supporting document for further details
Physical structure: functionality and sediment supply	Presence/ absence of physical barriers	Maintain the natural circulation of sediment and organic matter, without any physical obstructions	Dunes are naturally dynamic systems that require continuous supply and circulation of sand. Accumulation of organic matter in tidal litter is essential for trapping sand and initiating dune formation. Sea defence/coastal protection works are present near the main access point to the beach at Inishcrone (Ryle et al. 2009). See coastal habitats supporting document for further details
Vegetation structure: zonation	Occurrence	Maintain the range of coastal habitats including transitional zones, subject to natural processes including erosion and succession	Based on data from Ryle et al. (2009). At Bartragh Island there are transitions from sand dunes into saltmarsh habitats. See coastal habitats supporting document for further details
Vegetation composition: typical species and sub-communities	Percentage cover at a representative sample of monitoring stops	Maintain the presence of species-poor communities with typical species: sea rocket (*Cakile maritima*), sea sandwort (*Honckenya peploides*), prickly saltwort (*Salsola kali*) and Orache (*Atriplex* spp.)	Based on data from Ryle et al. (2009). See coastal habitats supporting document for further details
Vegetation composition: negative indicator species	Percentage cover	Negative indicator species (including non-natives) to represent less than 5% cover	Negative indicators include non-native species, species indicative of changes in nutrient status and species not considered characteristic of the habitat. Based on data from Ryle et al. (2009). See coastal habitats supporting document for further details

1310 Salicornia and other annuals colonizing mud and sand

To maintain the favourable conservation condition of *Salicornia* and other annuals colonizing mud and sand in Killala Bay/Moy Estuary SAC, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Habitat area	Hectares	Area stable or increasing, subject to natural processes, including erosion and succession. For sub-sites mapped: Bartragh Island- 0.26ha, Ross- 0.29ha. See map 6	Based on data from Saltmarsh Monitoring Project (SMP) (McCorry, 2007). Habitat mapped at two of the four sub-sites surveyed, giving a total estimated area of 0.55ha. NB further unsurveyed areas maybe present within the site. See coastal habitats supporting document for further details
Habitat distribution	Occurrence	No decline, or change in habitat distribution, subject to natural processes. See map 6 for known distribution	Based on data from McCorry (2007). Salicornia is an annual species, so its distribution can vary significantly from year to year. See coastal habitats supporting document for further details
Physical structure: sediment supply	Presence/ absence of physical barriers	Maintain natural circulation of sediments and organic matter, without any physical obstructions	Based on data from McCorry (2007). Sediment supply is particularly important for this pioneer saltmarsh community, as the distribution of this habitat depends on accretion rates. Accretion was noted at Ross and Bartragh Island. Old seawalls were recorded at Bartragh Island and some protection works were noted around buildings close to the shoreline at Ross. See coastal habitats backing document for further details
Physical structure: creeks and pans	Occurrence	Maintain creek and pan structure, subject to natural processes, including erosion and succession	Based on data from McCorry and Ryle (2009). Creeks deliver sediment throughout saltmarsh system. Creeks and pan structures are well developed at Ross. See coastal habitats supporting document for further details
Physical structure: flooding regime	Hectares flooded; frequency	Maintain natural tidal regime	This pioneer saltmarsh community requires regular tidal inundation. See coastal habitats supporting document for further details
Vegetation structure: zonation	Occurrence	Maintain the range of coastal habitats including transitional zones, subject to natural processes including erosion and succession	Based on data from McCorry (2007). Transitions to dune habitats are found at Bartragh Island and Ross. See coastal habitats supporting document for further details
Vegetation structure: vegetation height	Centimeters	Maintain structural variation within sward	Based on data from McCorry (2007). At Castleconor, grazing is absent. There are moderate levels of grazing at Rusheens, while grazing at Ross is heavy in places. Grazing intensity is low on Bartragh Island See coastal habitats supporting document for further details

1310 Salicornia and other annuals colonizing mud and sand

To maintain the favourable conservation condition of *Salicornia* and other annuals colonizing mud and sand in Killala Bay/Moy Estuary SAC, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Vegetation structure: vegetation cover	Percentage cover at a representative sample of monitoring stops	Maintain more than 90% of the area outside of the creeks vegetated	Based on data from McCorry (2007). Castleconor and Rusheens are heavily poached in places. There are moderate levels of poaching at Bartragh Island and Ross. See coastal habitats supporting document for further details
Vegetation composition: typical species & sub-communities	Percentage cover	Maintain the presence of species-poor communities with typical species listed in the Saltmarsh Monitoring Project (McCorry and Ryle, 2009)	See coastal habitats supporting document for further details
Vegetation structure: negative indicator species-*Spartina anglica*	Hectares	No significant expansion of common cordgrass (*Spartina anglica*), with an annual spread of less than 1%	Based on data from McCorry (2007). See coastal habitats supporting document for further details

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

To maintain the favourable conservation condition of Atlantic salt meadows (*Glauco-Puccinellietalia*) in Killala Bay/Moy Estuary SAC, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Habitat area	Hectares	Area stable or increasing, subject to natural processes, including erosion and succession. For sub-sites mapped: Bartragh Island- 29.22ha, Ross- 14.95ha, Rusheens- 1.24ha, Castleconor - 1.61ha. See map 6	Based on data from the Saltmarsh Monitoring Project (SMP) (McCorry, 2007; McCorry and Ryle 2009). Four sub-sites that supported Atlantic salt meadow were mapped (47.02ha) and additional areas of potential ASM (3.34ha) were identified from an examination of aerial photographs, giving a total estimated area of 50.37ha. NB further unsurveyed areas maybe present within the site. See coastal habitats supporting document for further details
Habitat distribution	Occurrence	No decline, or change in habitat distribution, subject to natural processes. See map 6 for known distribution	Based on data from McCorry (2007). ASM is the dominant saltmarsh type with a wide distribution throughout the SAC. See coastal habitats supporting document for further details
Physical structure: sediment supply	Presence/ absence of physical barriers	Maintain natural circulation of sediments and organic matter, without any physical obstructions	Based on data from McCorry and Ryle (2009). The SMP noted accretion at Ross and Bartragh Island. Old seawalls were recorded at Bartragh Island and there are some protection works around buildings close to the shoreline at Ross. See coastal habitats supporting document for further details
Physical structure: creeks and pans	Occurrence	Maintain creek and pan structure/ allow to develop, subject to natural processes, including erosion and succession	Based on data from McCorry and Ryle (2009). Creeks and pan structures are well developed at Ross. See coastal habitats supporting document for further details
Physical structure: flooding regime	Hectares flooded; frequency	Maintain natural tidal regime	See coastal habitats supporting document for further details
Vegetation structure: zonation	Occurrence	Maintain the range of coastal habitats including transitional zones, subject to natural processes including erosion and succession	Based on data from McCorry (2007). Transitions to dune habitats are found at Bartragh Island and Ross. See coastal habitats supporting document for further details
Vegetation structure: vegetation height	Centimeters	Maintain structural variation within sward	Based on data from McCorry (2007). At Castleconor, grazing is absent. At Rusheens there are moderate levels of grazing. At Ross grazing is heavy in places. At Bartragh Island grazing intensity is low. See coastal habitats supporting document for further details

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

To maintain the favourable conservation condition of Atlantic salt meadows (*Glauco-Puccinellietalia*) in Killala Bay/Moy Estuary SAC, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Vegetation structure: vegetation cover	Percentage cover at a representative sample of monitoring stops	Maintain more than 90% of the area outside of the creeks vegetated	Based on data from McCorry (2007). Castleconor and Rusheens are heavily poached in places. There are moderate levels of poaching at Bartragh Island and Ross. See coastal habitats supporting document for further details
Vegetation composition: typical species and sub-communities	Percentage cover at a representative sample of monitoring stops	Maintain range of sub-communities with typical species listed in Saltmarsh Monitoring Project (McCorry and Ryle, 2009)	Based on data from McCorry and Ryle (2009). See coastal habitats supporting document for further details
Vegetation structure: negative indicator species-*Spartina anglica*	Hectares	No significant expansion of common cordgrass (*Spartina anglica*), with an annual spread of less than 1%	Based on data from McCorry (2007). See coastal habitats supporting document for further details

1365 Harbour Seal *Phoca vitulina*

To maintain the favourable conservation condition of Harbour Seal in Killala Bay/Moy Estuary SAC, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Access to suitable habitat	Number of artificial barriers	Species range within the site should not be restricted by artificial barriers to site use. See map 9 for suitable habitat	See marine supporting document for further details
Breeding behaviour	Breeding sites	Conserve the breeding sites in a natural condition. See map 9	Attribute and target based on background knowledge of Irish breeding populations, review of data summarised by Summers et al. (1980), Harrington (1990), Lyons (2004) and unpublished National Parks and Wildlife Service records. See marine supporting document for further details
Moulting behaviour	Moult haul-out sites	Conserve the moult haul-out sites in a natural condition. See map 9	Attribute and target based on background knowledge of Irish populations, review of data from Lyons (2004), Cronin et al. (2004), NPWS (2010), NPWS (2011), NPWS (2012) and unpublished National Parks and Wildlife Service records. See marine supporting document for further details
Resting behaviour	Resting haul-out sites	Conserve the resting haul-out sites in a natural condition. See map 9	Attribute and target based on background knowledge of Irish populations, review of data from Lyons (2004), unpublished National Parks and Wildlife Service records and unpublished data collected by University College Cork/Inland Fisheries Ireland. See marine supporting document for further details
Disturbance	Level of impact	Human activities should occur at levels that do not adversely affect the harbour seal population at the site	See marine supporting document for further details

2110 Embryonic shifting dunes

To restore the favourable conservation condition of Embryonic shifting dunes in Killala Bay/Moy Estuary SAC, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Habitat area	Hectares	Area increasing, subject to natural processes, including erosion and succession. For sub-site mapped: Ross-0.81ha, Bartragh Island - 0.75ha. See map 7	Based on data from the Coastal Monitoring Project (Ryle et al., 2009). Habitat is very difficult to measure in view of its dynamic nature and was only recorded at Bartragh Island and Ross, giving a total estimated area of 1.56ha. Accretion was noted from the western end of Bartragh Island. Embryo dune habitat is restricted to a small area on the seaward edge at Ross. See coastal habitats supporting document for further details
Habitat distribution	Occurrence	No decline, or change in habitat distribution, subject to natural processes. See map 7 for known distribution	Based on data from Ryle et al. (2009). See coastal habitats supporting document for further details
Physical structure: functionality and sediment supply	Presence/ absence of physical barriers	Maintain the natural circulation of sediment and organic matter, without any physical obstructions	Dunes are naturally dynamic systems that require continuous supply and circulation of sand. Sea defence/coastal protection works are present near the main access point to the beach at Inishcrone (Ryle et al. 2009). See coastal habitats supporting document for further details
Vegetation structure: zonation	Occurrence	Maintain the range of coastal habitats including transitional zones, subject to natural processes including erosion and succession	Based on data from Gaynor (2008) and Ryle et al. (2009). At Bartragh Island and Ross there are transitions from sand dunes into saltmarsh habitats. See coastal habitats supporting document for further details
Vegetation composition: plant health of foredune grasses	Percentage cover	More than 95% of sand couch (*Elytrigia juncea*) and/or lyme-grass (*Leymus arenarius*) should be healthy (i.e. green plant parts above ground and flowering heads present)	Based on data from Ryle et al. (2009). See coastal habitats supporting document for further details
Vegetation composition: typical species and sub-communities	Percentage cover at a representative sample of monitoring stops	Maintain the presence of species-poor communities with typical species: sand couch (*Elytrigia juncea*) and/or lyme-grass (*Leymus arenarius*)	Based on data from Ryle et al. (2009). See coastal habitats supporting document for further details
Vegetation composition: negative indicator species	Percentage cover	Negative indicator species (including non-natives) to represent less than 5% cover	Based on data from Ryle et al. (2009). Negative indicators include non-native species, species indicative of changes in nutrient status and species not considered characteristic of the habitat. Sea-buckthorn (*Hippophae rhamnoides*) should be absent or effectively controlled. See coastal habitats supporting document for further details

2120 Shifting dunes along the shoreline with *Ammophila arenaria* ('white dunes')

To restore the favourable conservation condition of Shifting dunes along the shoreline with *Ammophila arenaria* (white dunes) in Killala Bay/Moy Estuary SAC, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Habitat area	Hectares	Area increasing, subject to natural processes including erosion and succession. For sub-sites mapped: Ross- 1.58; Bartragh Island- 7.52ha ; Inishcrone- 3.65ha. See map 7	Habitat was mapped during the Coastal Monitoring Project (Ryle et al., 2009). Habitat was mapped at three sub-sites to give a total estimated area of 12.75ha. Habitat is very difficult to measure in view of its dynamic nature. See coastal habitats supporting document for further details
Habitat distribution	Occurrence	No decline, or change in habitat distribution, subject to natural processes. See map 7 for known distribution	Based on data from Ryle et al. (2009). Mobile dunes are well developed at Bartragh Island, while at Inishcrone they are patchy in distribution and eroded back to the fixed dune in places. See coastal habitats supporting document for further details
Physical structure: functionality and sediment supply	Presence/ absence of physical barriers	Maintain the natural circulation of sediment and organic matter, without any physical obstructions	Dunes are naturally dynamic systems that require continuous supply and circulation of sand. Marram (*Ammophila arenaria*) reproduces vegetatively and requires constant accretion of fresh sand to maintain active growth, thus encouraging further accretion. There are coastal protection works in place at Inishcrone. See coastal habitats supporting document for further details
Vegetation structure: zonation	Occurrence	Maintain the range of coastal habitats including transitional zones, subject to natural processes including erosion and succession	Based on data from Gaynor (2008) and Ryle et al. (2009). At both Bartragh Island and Ross there are transitions from sand dune to saltmarsh habitats. See coastal habitats supporting document for further details
Vegetation composition: plant health of dune grasses	Percentage cover	More than 95% of marram (*Ammophila arenaria*) and/or lyme-grass (*Leymus arenarius*) should be healthy (i.e. green plant parts above ground and flowering heads present)	Based on data from Ryle et al. (2009). See coastal habitats supporting document for further details
Vegetation composition: typical species and sub-communities	Percentage cover at a representative sample of monitoring stops	Maintain the presence of species-poor communities dominated by marram (*Ammophila areanaria*) and/or lyme-grass (*Leymus arenarius*)	Based on data from Ryle et al. (2009). Bartragh Island, Ross and Inishcrone all support a characteristic dune flora. See coastal habitats supporting document for further details

2120 Shifting dunes along the shoreline with *Ammophila arenaria* ('white dunes')

To restore the favourable conservation condition of Shifting dunes along the shoreline with *Ammophila arenaria* (white dunes) in Killala Bay/Moy Estuary SAC, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Vegetation composition: negative indicator species	Percentage cover	Negative indicator species (including non-natives) to represent less than 5% cover	Based on data from Ryle et al. (2009). Negative indicators include non-native species, species indicative of changes in nutrient status and species not considered characteristic of the habitat. Sea-buckthorn (*Hippophae rhamnoides*) should be absent or effectively controlled. The mobile dune habitat at Ross has a high cover of creeping thistle (*Cirsium arvense*) and common ragwort (*Senecio jacobaea)*. At Inishcrone and Bartragh Island, ragwort (*Senecio jacobaea*) is also common. See coastal habitats supporting document for further details

2130 *Fixed coastal dunes with herbaceous vegetation ('grey dunes')

To restore the favourable conservation condition of Fixed coastal dunes with herbaceous vegetation (grey dunes) in Killala Bay/Moy Estuary SAC, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Habitat area	Hectares	Area increasing, subject to natural processes including erosion and succession. For sub-site mapped: Ross - 100.79ha; Bartragh Island - 120.13ha; Inishcrone - 38.53ha. See map 7	Based on data from the Coastal Monitoring Project (Ryle et al., 2009). Habitat mapped at three sub-sites to give a total estimated area of 259.46ha. See coastal habitats supporting document for further details
Habitat distribution	Occurrence	No decline, or change in habitat distribution, subject to natural processes. See map 7 for known distribution	Based on data from the Coastal Monitoring Project (Ryle et al., 2009). Fixed dune habitat is extensive at Bartragh Island. The extent of the fixed dune habitat is reduced at Inishcrone owing to presence of Enniscrone golf course. See coastal habitats supporting document for further details
Physical structure: functionality and sediment supply	Presence/ absence of physical barriers	Maintain the natural circulation of sediment and organic matter, without any physical obstructions.	Based on data from the Coastal Monitoring Project (Ryle et al., 2009). Physical barriers can lead to fossilisation or over-stabilisation of dunes, as well as beach starvation resulting in increased rates of erosion. There are coastal protection works at the main access to the beach at Inishcrone. See coastal habitats supporting document for further details
Vegetation structure: zonation	Occurrence	Maintain the range of coastal habitats including transitional zones, subject to natural processes including erosion and succession	Based on data from Ryle et al. (2009). At both Bartragh Island and Ross there are transitions from sand dune to saltmarsh habitats. See coastal habitats supporting document for further details
Vegetation structure: bare ground	Percentage cover	Bare ground should not exceed 10% of fixed dune habitat, subject to natural processes.	Based on data from Gaynor (2008) and Ryle et al. (2009). See coastal habitats supporting document for further details
Vegetation composition: sward height	Centimeters	Maintain structural variation within sward.	Based on data from Gaynor (2008) and Ryle et al. (2009). Vegetation is quite rank in places at Ross, Inishcrone and Bartragh Island due to undergrazing. See coastal habitats supporting document for further details
Vegetation composition: typical species and sub-communities	Percentage cover at a representative sample of monitoring stops	Maintain range of sub-communities with typical species listed in Ryle et al. (2009)	Based on data from Gaynor (2008) and Ryle et al. (2009). See coastal habitats supporting document for further details

2130 *Fixed coastal dunes with herbaceous vegetation ('grey dunes')

To restore the favourable conservation condition of Fixed coastal dunes with herbaceous vegetation (grey dunes) in Killala Bay/Moy Estuary SAC, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Vegetation composition: negative indicator species (including *Hippophae rhamnoides*)	Percentage cover	Negative indicator species (including non-natives) to represent less than 5% cover	Based on data from Ryle et al. (2009). Negative indicators include non-native species, species indicative of changes in nutrient status and species not considered characteristic of the habitat. Sea-buckthorn (*Hippophae rhamnoides*) should be absent or effectively controlled. Bracken (*Pteridium aquilinum*) was recorded at Bartragh Island. At Inishcrone, common ragwort (*Senecio jacobaea*), creeping thistle (*Cirsium vulgare*) and bramble (*Rubus fruticosus*) occur. At Ross, creeping thistle (*Cirsium arvense*), common ragwort (*Senecio jacobaea*) and hogweed (*Heracleum sphondylium*) occur. See coastal habitats supporting document for further details
Vegetation composition: scrub/trees	Percentage cover	No more than 5% cover or under control	Based on data from Ryle et al. (2009). Scattered shrubs and stunted trees occur at Ross, while occasional scrub occurs at Bartragh Island. See coastal habitats supporting document for further details

2190 Humid dune slacks

To maintain the favourable conservation condition of Humid dune slacks in Killala Bay/Moy Estuary SAC, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Habitat area	Hectares	Area stable or increasing, subject to natural processes including erosion and succession. For sub-sites mapped: Ross: 3.87ha; Bartragh Island: 1.22ha. See map 6	Based on data from the Coastal Monitoring Project (Ryle et al., 2009). Habitat was mapped at two sub-sites, giving a total estimated area of 5.09ha. See coastal habitats supporting document for further details
Habitat distribution	Occurrence	No decline or change in habitat distribution, subject to natural processes. See map 6 for known distribution	Based on data from Ryle et al. (2009). Dune slacks at Bartragh Island are narrow linear features. See coastal habitats supporting document for further details.
Physical structure: functionality and sediment supply	Presence/ absence of physical barriers	Maintain natural circulation of sediment and organic matter, without any physical obstructions	Physical barriers can lead to fossilisation or over-stabilisation of dunes, as well as beach starvation resulting in increased rates of erosion. See coastal habitats supporting document for further details
Physical structure: hydrological and flooding regime	Presence/ absence of water abstraction or drainage works	Maintain natural hydrological regime	Based on data from Gaynor (2008) and Ryle et al. (2009). See coastal habitats supporting document for further details
Vegetation structure: zonation	Occurrence	Maintain the range of coastal habitats including transitional zones, subject to natural processes including erosion and succession	Based on data from Ryle et al., (2009). At both Bartragh Island and Ross sub-sites there are transitions from sand dune to saltmarsh habitats. See coastal habitats supporting document for further details
Vegetation structure: bare ground	Percentage cover	Bare ground should not exceed 5% of dune slack habitat, with the exception of pioneer slacks which can have up to 20% bare ground.	Based on data from Gaynor (2008) and Ryle et al. (2009). At Ross, the dune slacks are poached by cattke in places. See coastal habitats supporting document for further details
Vegetation structure: vegetation height	Centimeters	Maintain structural variation within sward.	Based on data from Ryle et al. (2009). See coastal habitats supporting document for further details
Vegetation composition: typical species and sub-communities	Percentage cover at a representative sample of monitoring stops	Maintain range of sub-communities with typical species listed in Ryle et al. (2009)	Based on data from Gaynor (2008) and Ryle et al. (2009). See coastal habitats supporting document for further details
Vegetation composition: cover of S. repens	% cover; centimeters	Maintain more than 40% cover of creeping willow (*Salix repens*)	Based on data from Ryle et al. (2009). Cover of creeping willow (*Salix repens*) needs to be controlled (e.g. through an appropriate grazing regime) to prevent the development of a coarse, rank vegetation cover. *Salix repens* ssp. *argentea* was noted at Bartragh Island, but its cover was only 10% and it was not widespread. See coastal habitats supporting document for further details

2190 Humid dune slacks

To maintain the favourable conservation condition of Humid dune slacks in Killala Bay/Moy Estuary SAC, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Vegetation composition: negative indicator species	Percentage cover	Negative indicator species (including non-natives) to represent less than 5% cover	Based on data from Ryle et al. (2009). Negative indicators include non-native species, species indicative of changes in nutrient status and species not considered characteristic of the habitat. Sea-buckthorn (*Hippophae rhamnoides*) should be absent or effectively controlled. See coastal habitats supporting document for further details
Vegetation composition: scrub/trees	Percentage cover	No more than 5% cover or under control	Based on data from Ryle et al. (2009). See coastal habitats supporting document for further details

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MAP 1:
KILLALA BAY / MOY ESTUARY SAC
CONSERVATION OBJECTIVES
SAC DESIGNATION

Map to be read in conjunction with the NPWS Conservation Objectives Document.

SITE CODE: SAC 000458
CO.MAYO; version 1.01, CO. SLIGO; version 1.01

0 0.5 1 1.5 2 km

N

Map Version 1
Date: Aug 2012

Legend

- SAC 000458 Killala Bay/Moy Estuary
- SAC 002298 River Moy
- SPA 004036 Killala Bay/Moy Estuary
- OSi Discovery Series County Boundaries

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MAP 2:
KILLALA BAY / MOY ESTUARY SAC
CONSERVATION OBJECTIVES
ADJOINING / OVERLAPPING DESIGNATIONS

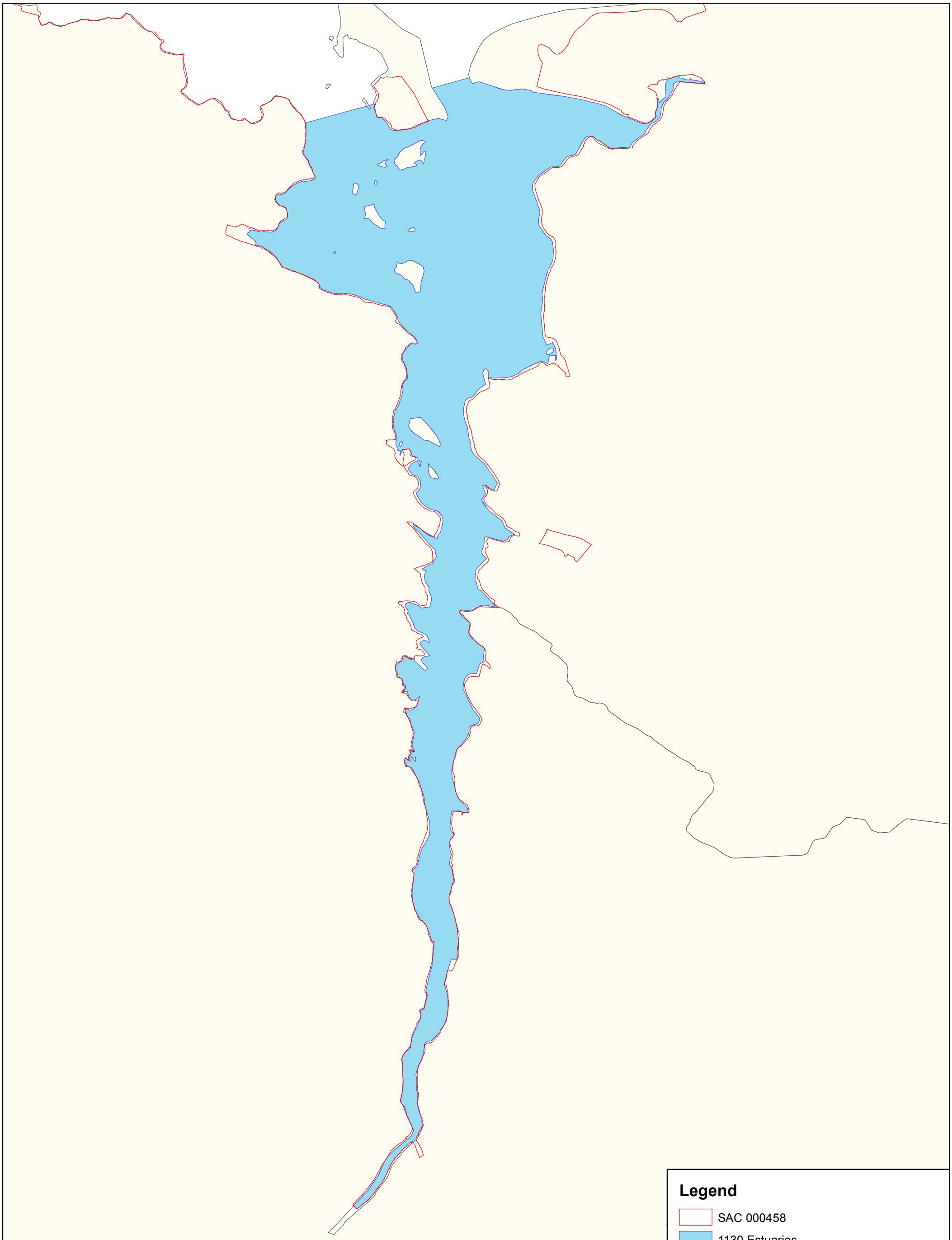
Map to be read in conjunction with the NPWS Conservation Objectives Document.

SITE CODE:
SAC 000458 CO.MAYO; version 1.01, CO.SLIGO; version 1.01
SAC 002298 CO.MAYO; version 1.14, CO.SLIGO; version 1.09
SPA 004036 CO.MAYO; version 1.02, CO.SLIGO; version 1.02

0 2 4 6 8 10 km

N

Map Version 1
Date: Aug 2012



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MAP 3:
KILLALA BAY / MOY ESTUARY SAC
CONSERVATION OBJECTIVES
ESTUARIES

Map to be read in conjunction with the NPWS Conservation Objectives Document.

SITE CODE: SAC 000458
CO.MAYO; version 1.01, CO. SLIGO; version 1.01

0 0.2 0.4 0.6 0.8 1 km

N

Map Version 1
Date: Aug 2012

Legend

- SAC 000458
- 1140 Mudflats and sandflats not covered by seawater at low tide
- OSi Discovery Series County Boundaries

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MAP 4:
KILLALA BAY / MOY ESTUARY SAC
CONSERVATION OBJECTIVES
TIDAL MUDFLATS AND SANDFLATS

Map to be read in conjunction with the NPWS Conservation Objectives Document.

SITE CODE: SAC 000458
CO.MAYO; version 1.01, CO. SLIGO; version 1.01

0 0.5 1 1.5 2 km

N

Map Version 1
Date: Aug 2012

Legend

- SAC 000458
- OSi Discovery Series County Boundaries

Marine Community Types

- Estuarine muddy sand dominated by *Hediste diversicolor* and *Heterochaeta costata* community complex
- Fine sand dominated by *Nephtys cirrosa* community complex
- Muddy sand to fine sand dominated by *Hydrobia ulvae, Pygospio elegans* and *Tubificoides benedii* community complex
- River
- *Zostera*-dominated community

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MAP 5:
KILLALA BAY / MOY ESTUARY SAC
CONSERVATION OBJECTIVES
MARINE COMMUNITY TYPES

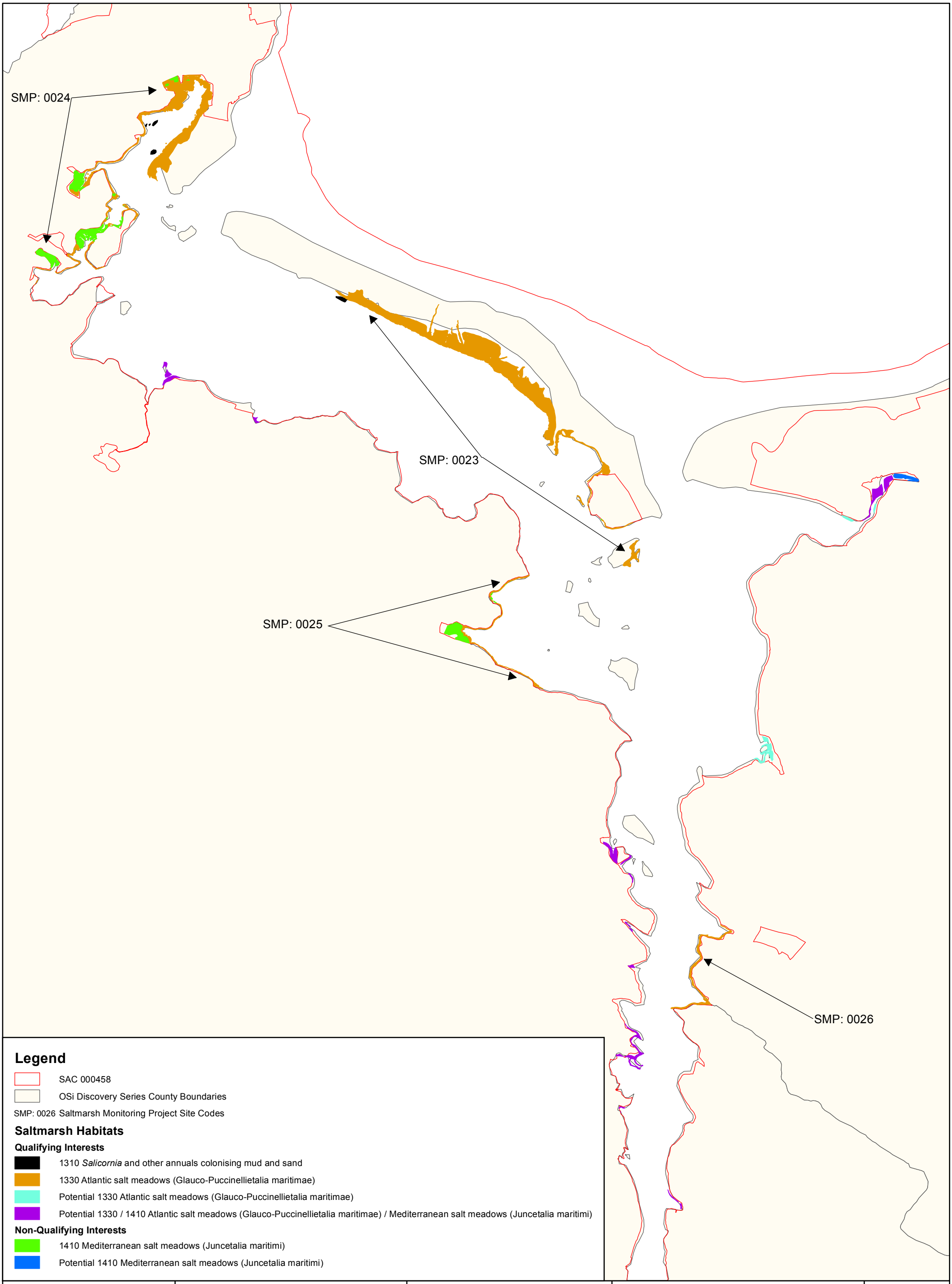
Map to be read in conjunction with the NPWS Conservation Objectives Document.

SITE CODE: SAC 000458
CO.MAYO; version 1.01, CO. SLIGO; version 1.01

0 0.5 1 1.5 2 km

N

Map Version 1
Date: Aug 2012



Legend

- SAC 000458
- OSi Discovery Series County Boundaries
- SMP: 0026 Saltmarsh Monitoring Project Site Codes

Saltmarsh Habitats

Qualifying Interests

- 1310 *Salicornia* and other annuals colonising mud and sand
- 1330 Atlantic salt meadows (Glauco-Puccinellietalia maritimae)
- Potential 1330 Atlantic salt meadows (Glauco-Puccinellietalia maritimae)
- Potential 1330 / 1410 Atlantic salt meadows (Glauco-Puccinellietalia maritimae) / Mediterranean salt meadows (Juncetalia maritimi)

Non-Qualifying Interests

- 1410 Mediterranean salt meadows (Juncetalia maritimi)
- Potential 1410 Mediterranean salt meadows (Juncetalia maritimi)

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MAP 6:
KILLALA BAY / MOY ESTUARY SAC CONSERVATION OBJECTIVES SALTMARSH HABITATS

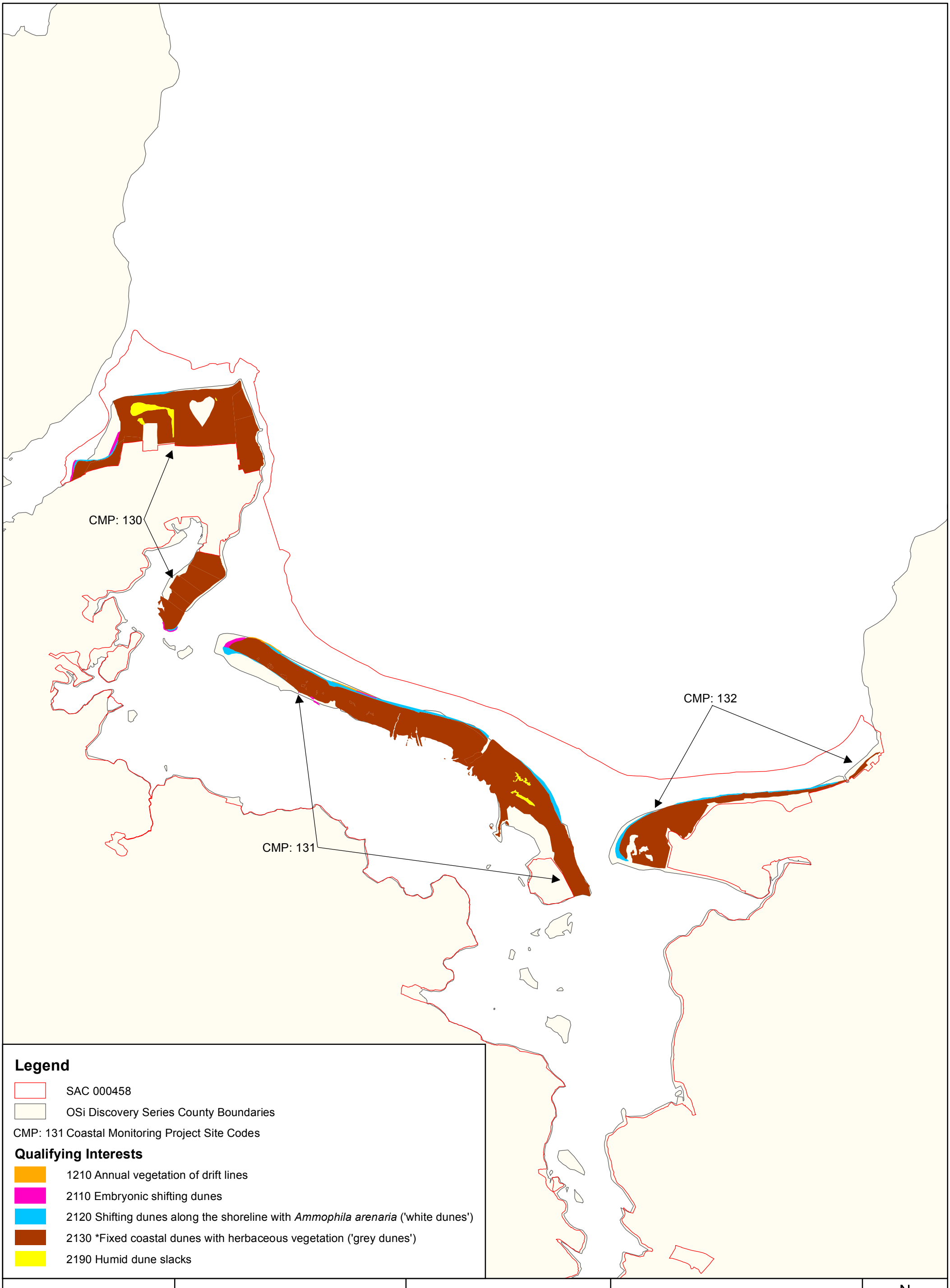
Map to be read in conjunction with the NPWS Conservation Objectives Document.

SITE CODE: SAC 000458
CO.MAYO; version 1.01, CO. SLIGO; version 1.01

0 0.5 1 km

N

Map Version 1
Date: Aug 2012



Legend

SAC 000458

OSi Discovery Series County Boundaries

CMP: 131 Coastal Monitoring Project Site Codes

Qualifying Interests

1210 Annual vegetation of drift lines

2110 Embryonic shifting dunes

2120 Shifting dunes along the shoreline with *Ammophila arenaria* ('white dunes')

2130 *Fixed coastal dunes with herbaceous vegetation ('grey dunes')

2190 Humid dune slacks

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MAP 7:
KILLALA BAY / MOY ESTUARY SAC
CONSERVATION OBJECTIVES
SAND DUNE HABITATS

Map to be read in conjunction with the NPWS Conservation Objectives Document.

SITE CODE: SAC 000458
CO.MAYO; version 1.01, CO. SLIGO; version 1.01

0 0.5 1 km

N

Map Version 1
Date: Aug 2012

Legend

- SAC 000458
- 1014 Narrow-Mouthed Whorl Snail - *Vertigo angustior*
- OSi Discovery Series County Boundaries

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MAP 8:
KILLALA BAY / MOY ESTUARY SAC
CONSERVATION OBJECTIVES
NARROW-MOUTHED WHORL SNAIL

Map to be read in conjunction with the NPWS Conservation Objectives Document.

SITE CODE: SAC 000458
CO.MAYO; version 1.01, CO. SLIGO; version 1.01

0 0.5 1 1.5 2 km

N

Map Version 1
Date: Aug 2012

Legend

- SAC 000458
- 1365 Harbour Seal - *Phoca vitulina* breeding sites
- 1365 Harbour Seal - *Phoca vitulina* moulting sites
- 1365 Harbour Seal - *Phoca vitulina* resting sites
- 1365 Harbour Seal - *Phoca vitulina* habitat
- OSi Discovery Series County Boundaries

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MAP 9:
KILLALA BAY / MOY ESTUARY SAC
CONSERVATION OBJECTIVES
HARBOUR SEAL

Map to be read in conjunction with the NPWS Conservation Objectives Document.

SITE CODE: SAC 000458
CO.MAYO; version 1.01, CO. SLIGO; version 1.01

0 0.5 1 1.5 2 km

N

Map Version 1
Date: Aug 2012

National Parks and Wildlife Service

Conservation Objectives

Clew Bay Complex SAC 001482

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Department of
Arts, Heritage and the Gaeltacht

Introduction

The overall aim of the Habitats Directive is to maintain or restore the favourable conservation status of habitats and species of community interest. These habitats and species are listed in the Habitats and Birds Directives and Special Areas of Conservation and Special Protection Areas are designated to afford protection to the most vulnerable of them. These two designations are collectively known as the Natura 2000 network.

European and national legislation places a collective obligation on Ireland and its citizens to maintain habitats and species in the Natura 2000 network at favourable conservation condition. The Government and its agencies are responsible for the implementation and enforcement of regulations that will ensure the ecological integrity of these sites.

A site-specific conservation objective aims to define favourable conservation condition for a particular habitat or species at that site.

The maintenance of habitats and species within Natura 2000 sites at favourable conservation condition will contribute to the overall maintenance of favourable conservation status of those habitats and species at a national level.

Favourable conservation status of a habitat is achieved when:

- its natural range, and area it covers within that range, are stable or increasing, and
- 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.

The 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, and
- 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.

Notes/Guidelines:

1. The targets given in these conservation objectives are based on best available information at the time of writing. As more information becomes available, targets for attributes may change. These will be updated periodically, as necessary.
2. An appropriate assessment based on these conservation objectives will remain valid even if the targets are subsequently updated, providing they were the most recent objectives available when the assessment was carried out. It is essential that the date and version are included when objectives are cited.
3. Assessments cannot consider an attribute in isolation from the others listed for that habitat or species, or for other habitats and species listed for that site. A plan or project with an apparently small impact on one attribute may have a significant impact on another.
4. Please note that the maps included in this document do not necessarily show the entire extent of the habitats and species for which the site is listed. This should be borne in mind when appropriate assessments are being carried out.
5. When using these objectives, it is essential that the relevant backing/supporting documents are consulted, particularly where instructed in the targets or notes for a particular attribute.

Qualifying Interests

**** indicates a priority habitat under the Habitats Directive***

001482 Clew Bay Complex SAC

QI	Description
1013	Geyer's whorl snail *Vertigo geyeri*
1140	Mudflats and sandflats not covered by seawater at low tide
1150	* Coastal lagoons
1160	Large shallow inlets and bays
1210	Annual vegetation of drift lines
1220	Perennial vegetation of stony banks
1330	Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*)
1355	Otter *Lutra lutra*
1365	Common seal *Phoca vitulina*
2110	Embryonic shifting dunes
2120	Shifting dunes along the shoreline with *Ammophila arenaria* ("white dunes")

Supporting documents, relevant reports & publications (listed by date)

Supporting documents, NPWS reports and publications are available for download from: www.npws.ie/Publications

Title: Monitoring and Assessment of Irish Lagoons for the purpose of the EU Water Framework Directive
Year: in prep
Author: Roden, C.M.; Oliver, G.
Series: Unpublished report to the EPA

Title: Clew Bay Complex SAC (001482): Conservation objectives supporting document - marine habitats and species [Version 1]
Year: 2011
Author: NPWS
Series: Unpublished Report to NPWS

Title: Clew Bay Complex SAC (001482): Conservation objectives supporting document - coastal habitats [Version 1]
Year: 2011
Author: NPWS
Series: Unpublished Report to NPWS

Title: Otter tracking study of Roaringwater Bay
Year: 2010
Author: De Jongh, A.; O'Neill, L.
Series: Unpublished Draft Report to NPWS

Title: Subtidal benthic surveys (Clew Bay)
Year: 2009
Author: Aquafact
Series: Unpublished Report to NPWS

Title: Saltmarsh Monitoring Report 2007-2008
Year: 2009
Author: McCorry, M.; Ryle, T.
Series: Unpublished Report to NPWS

Title: Clew Bay baseline intertidal survey
Year: 2009
Author: RPS
Series: Unpublished Report to NPWS

Title: Coastal Monitoring Project 2004-2006
Year: 2009
Author: Ryle, T.; Murray, A.; Connolly, C.; Swann, M.
Series: Unpublished Report to NPWS

Title: The phytosociology and conservation value of Irish sand dunes
Year: 2008
Author: Gaynor, K.
Series: Unpublished PhD thesis, National University of Ireland, Dublin

Title: Saltmarsh Monitoring Report 2006

Year: 2007

Author: McCorry, M.

Series: Unpublished Report to NPWS

Title: Inventory of Irish coastal lagoons

Year: 2007

Author: Oliver, G.

Series: Unpublished Report to NPWS

Title: A Survey of Intertidal Mudflats and Sandflats in Ireland

Year: 2006

Author: Aquafact

Series: Unpublished Report to NPWS

Title: Otter Survey of Ireland 2004/2005

Year: 2006

Author: Bailey, M.; Rochford, J.

Series: Irish Wildlife Manuals No. 23

Title: Otters - ecology, behaviour and conservation

Year: 2006

Author: Kruuk, H.

Series: Oxford University Press

Title: Survey of sensitive subtidal benthic marine communities

Year: 2006

Author: MERC

Series: Unpublished Report to NPWS

Title: Harbour seal population assessment in the Republic of Ireland: August 2003

Year: 2004

Author: Cronin, M.; Duck, C.; Ó Cadhla, O.; Nairn, R.; Strong, D.; O'Keeffe, C.

Series: Irish Wildlife Manuals No. 11

Title: Summary of National Parks & Wildlife Service surveys for common (harbour) seals (*Phoca vitulina*) and grey seals (*Halichoerus grypus*), 1978 to 2003

Year: 2004

Author: Lyons, D.O.

Series: Irish Wildlife Manuals No. 13

Title: Broadscale mapping of candidate marine Special Area of Conservation. Clew Bay Complex, cSAC (001482)

Year: 2003

Author: SSI; Aquafact

Series: Unpublished Report to NPWS

Title: A Survey of selected littoral and sublittoral sites in Clew Bay, Co. Mayo

Year: 1999

Author: Aquafact

Series: Unpublished Report to NPWS

Title: National Shingle Beach Survey of Ireland 1999

Year: 1999

Author: Moore, D.; Wilson, F.

Series: Unpublished Report to NPWS

Title: Aquatic vegetation of Irish coastal lagoons

Year: 1998

Author: Hatch, P.; Healy, B.

Series: Bulletin of the Irish Biogeographical Society. 21: 2-21

Title: A survey of the vegetation of Irish coastal lagoons

Year: 1996

Author: Hatch, P.

Series: Unpublished Report to NPWS

Title: The spatial organization of otters (*Lutra lutra*) in Shetland

Year: 1991

Author: Kruuk, H.; Moorhouse, A.

Series: J. Zool, 224: 41-57

Title: Otter survey of Ireland

Year: 1982

Author: Chapman, P.J.; Chapman, L.L.

Series: Unpublished Report to Vincent Wildlife Trust

Title: Lough Furnace, County Mayo; physical and chemical studies of an Irish saline lake, with reference to the biology of *Neomysis integer*

Year: 1977

Author: Parker, M.M.

Series: Unpublished PhD thesis, University of Dublin, Trinity College.

Spatial data sources

Year:	Interpolated 2011
Title:	Intertidal and subtidal surveys 1999, 2006, 2009; broadscale mapping 2003
GIS operations:	Polygon feature classes from marine community types base data sub-divided based on interpolation of marine survey data; expert opinion used as necessary to resolve any issues arising
Used for:	Marine community types, 1140 (maps 2 & 4)
Year:	2005
Title:	OSi Discovery series vector data
GIS operations:	High Water Mark (HWM) polyline feature class converted into polygon feature class; clipped to SAC boundary
Used for:	1160, 1365 (maps 3 & 9)
Year:	2005
Title:	OSi Discovery series vector data
GIS operations:	High water mark (HWM) and low water mark (LWM) polyline feature classes converted into polygon feature classes and combined; Saltmarsh and Sand Dune CO datasets erased out if applicable
Used for:	Marine community types base data (map 4)
Year:	Revision 2011
Title:	Inventory of Irish Coastal Lagoons. Version 3
GIS operations:	Clipped to SAC boundary
Used for:	1150 (map 5)
Year:	Revision 2010
Title:	Saltmarsh Monitoring Project 2007-2008. Version 1
GIS operations:	QIs selected; clipped to SAC boundary; overlapping regions with Sand Dune CO data investigated and resolved with expert opinion used
Used for:	1330 (map 6)
Year:	2009
Title:	Coastal Monitoring Project 2004-2006. Version 1
GIS operations:	QIs selected; clipped to SAC boundary; overlapping regions with Saltmarsh CO data investigated and resolved with expert opinion used
Used for:	1210, 2110, 2120 (map 7)
Year:	2005
Title:	OSi Discovery series vector data
GIS operations:	Creation of an 80m buffer on the marine side of the high water mark (HWM); creation of a 10m buffer on the terrestrial side of the HWM; combination of 80m and 10m HWM buffer datasets; creation of a 10m buffer on the landward side of the river banks data; creation of a 20m buffer applied to river centerline and stream data; combination of 10m river banks and 20m river and stream centerline buffer datasets; combined river and stream buffer dataset clipped to HWM; combination of HWM buffer dataset with river and stream buffer dataset; overlapping regions investigated and resolved; resulting dataset clipped to SAC boundary; expert opinion used as necessary to resolve any issues arising
Used for:	1355 (map 8)

Year:	2011
Title:	NPWS rare and threatened species database
GIS operations:	Dataset created from spatial references in database records; expert opinion used as necessary to resolve any issues arising
Used for:	1365 (map 9)

1013 Geyer's whorl snail *Vertigo geyeri*

The status of Geyer's whorl snail as a qualifying Annex II species for Clew Bay Complex SAC is currently under review. The outcome of this review will determine whether a site-specific conservation objective is set for this species.

1140 Mudflats and sandflats not covered by seawater at low tide

To maintain the favourable conservation condition of Mudflats and sandflats not covered by seawater at low tide in Clew Bay Complex SAC, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Habitat area	Hectares	The permanent habitat area is stable or increasing, subject to natural processes. See map 2	Habitat area was estimated using OSI data as 1277ha. See marine supporting document for further details
Community distribution	Hectares	The following sediment communities should be maintained in a natural condition: Intertidal sandy mud with *Tubificoides benedii* and *Pygospio elegans* community complex; Sandy mud with polychaetes and bivalves community complex; and Fine sand dominated by *Nephtys cirrosa* community. See map 4	The likely area of sediment communities was derived from a combination of intertidal and subtidal surveys undertaken in 1999, 2006 and 2009. See marine supporting document for further details

1150 * Coastal lagoons

To maintain the favourable conservation condition of Lagoons in Clew Bay Complex SAC, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Habitat distribution	Occurrence	No decline, subject to natural processes. See map 5 for mapped lagoons	The main lagoon is Furnace Lough. Claggan Lagoon has also been mapped, however, further information is required on this lagoon. NB there maybe other lagoons within the SAC. The following targets and notes concentrate on the largest lagoon, Furnace Lough
Habitat area	Hectares	Area stable, subject to slight natural variation. Favourable reference area of surveyed lagoons is 163.3ha. Furnace Lough- 162.1ha; Claggan Lagoon- 1.2ha. See map 5	Areas calculated from spatial data derived from Oliver, 2007. NB there maybe other lagoons within the SAC
Salinity regime	Practical salinity units (psu)	Maintain current spatial and temporal variation in salinity regime	Furnace Lough is a natural, deep (up to 21m), stratified lagoon with natural periodic overturns and anoxia. It has permanent open connection to the sea through which seawater enters when tides exceed MHWN though this connection is somewhat constricted by weirs. There are major freshwater inputs at the northern end from the large Lough Feeagh/Burrishoole catchment area. The surface layer is oligohaline to mesohaline (0.5-12.0 psu) for most of the time but salinity varies from north (fresh water) to south (high salinity) and summer to winter. The waters are sharply stratified, a permanant halocline runs from 1-3m down to 8m, below which the water is of constant salinity (approx. 20psu), anaerobic and stagnant (Parker, 1977). See Oliver (2007) and Roden and Oliver (in prep.) for further information
Hydrological regime	Metres	Maintain current annual water level fluctuations	This is to ensure maintenance of the current communities of the lagoon margins and the current hydrological functioning of the lagoon itself, especially the salinity regime
Hydrological regime	Discharge (m^3/second)	Maintain/restore freshwater discharge regime	There is evidence that the original hydrological regime in the Burrishoole catchment has been impacted due to overgrazing and afforestation resulting in changes to run-off regimes with associated increased siltation and eutrophication. The extent to which these changes have impacted on Lough Furnace is unclear but needs further study

1150 * Coastal lagoons

To maintain the favourable conservation condition of Lagoons in Clew Bay Complex SAC, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Barrier	Weir function	Maintain current weir structure at Furnace Lough to ensure maintenance of the current salinity regime	In Furnace Lough, input to and output of saline water is affected to an unknown degree by two weirs. The effect of the weirs needs to be quantified to determine their effect on the salinity regime of the lagoon. These weirs or some similar type structures are shown on the first edition of the 6" OS maps and therefore have been in place for over 170 years
Water quality: chlorophyll a	µg/L	Maintain annual median chlorophyll in Furnace Lough at less than 2.5µg/L	These limits are needed to ensure that excessive shading from phytoplankton does not reduce submergent macrophytes colonisation of the littoral zone the lagoon (J. Ryan, pers comm). The current median levels are less than the target but summer levels are elevated (Roden and Oliver, in prep.) and should be closely monitored
Water quality: Molybdate Reactive Phosphorus (MRP)	mg/L	Maintain annual median MRP in Furnace Lough at less than 0.01mg/L	These limits are needed to ensure that excessive shading from phytoplankton does not reduce submergent macrophytes colonisation of the littoral zone areas of the lagoon (J. Ryan, pers comm). The current median levels in Furnace Lough are 0.005mg/L (Roden and Oliver, in prep). It is possible that the target may be exceeded during periods of overturn. Collection of data on nutrient levels close to the halocline would be useful for the assessment of this possibility
Water quality: Dissolved Inorganic Nitrogen (DIN)	mg/L	Maintain annual median DIN (Dissolved inorganic nitrogen) in Furnace Lough at less than 0.15mg/L	These limits are needed to ensure that excessive shading from phytoplankton does not reduce submergent macrophytes colonisation of the littoral zone of the lagoon (J. Ryan, pers comm). The current median levels of DIN in Furnace Lough are less than 0.1mg/L (Roden and Oliver, in prep)
Water quality: Biological Oxygen Demand (BOD)	mg/L	Maintain annual median BOD (Biological Oxygen Demand) in Furnace Lough at less than 2.0mg/L	These limits are needed to ensure that excessive shading from phytoplankton does not reduce submergent macrophytes colonisation of the littoral zone of the lagoon (J. Ryan, pers comm). The current annual median levels of BOD in Furnace Lough are just below the target (Roden and Oliver, in prep) and should be closely monitored. The relationship between organic matter, mainly peat silt, imput from L. Feeagh and BOD in the surface waters and anoxia in the deeper waters warrants further investigation

1150 * Coastal lagoons

To maintain the favourable conservation condition of Lagoons in Clew Bay Complex SAC, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Depth of submergent macrophyte colonisation	Metres	Maintain/increase the depth of submergent macrophyte colonisation of the lagoon	Increased depth of colonisation increases both the extent and diversity of submergent macrophytes. In comparison with similar lagoons the extent of submergent macrophyte colonisation in Furnace Lough appears to be restricted probably due to high water colour. However data on the depth of colonisation and water colour and the relationship between them is lacking. It is also possible that anoxia may be a problem, at least in some areas. These issues need to be investigated
Typical plant species	Number and m^2	Maintain number and extent of listed lagoonal specialists, subject to natural variation	Species in Furnace Lough listed in Oliver (2007), Hatch (1996) and Hatch and Healy (1998). A very limited number of plant species are currently listed for the site based on a series of shallow water transects. A snorkelling survey of this complex lagoon is required establish if that list is fully representative of the flora of the lagoon
Typical animal species	Number	Maintain listed lagoon specialists, subject to natural variation	Species in Furnace Lough listed in Oliver (2007), which rated the aquatic fauna as of moderate-high conservation value based on its high diversity and the presence of rare and unexpected crustaceans
Negative indicator species	Number and % cover	Negative indicator species absent or under control	Eutrophication would favour phytoplankton blooms at the expense of submerged macrophytes

1160 Large shallow inlets and bays

To maintain the favourable conservation condition of Large shallow inlets and bays in Clew Bay Complex SAC, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Habitat area	Hectares	The permanent habitat area is stable or increasing, subject to natural processes. See map 3	Habitat area was estimated using OSI data as 10189ha. See marine supporting document for further details.
Community extent	Hectares	Maintain the natural extent of the *Zostera* dominated and maërl dominated communities. See map 4	The likely extent of the *Zostera* dominated and maërl dominated communities was derived from the acoustic survey and the dive survey undertaken in 2006. See marine supporting document for further details
Shoot density	Shoots per m^2	Maintain the high quality of *Zostera* dominated community	2006 diver observation and underwater viewer. See marine supporting document for further details
Community structure	Biological composition	Maintain the high quality of maërl dominated communities	Area established from an acoustic mapping survey 2003 and a 2006 diver observation and underwater viewer. See marine supporting document for further details
Community distribution	Hectares	The following communities should be maintained in a natural condition: Sandy mud with polychaetes and bivalves community complex; Fine sand dominated by *Nephtys cirrosa* community; Intertidal sandy mud with *Tubificoides benedii* and *Pygospio elegans* community complex; Shingle; and Reef. See map 4	The likely area of sediment communities was derived from a combination of acoustic mapping survey in 2003, intertidal data from 1999, 2006 and 2009 and subtidal data obtained in 1999 and 2009. See marine supporting document for further details

1210 Annual vegetation of drift lines

To maintain the favourable conservation condition of Annual vegetation of driftlines in Clew Bay Complex SAC, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Habitat area	Hectares	Area stable or increasing, subject to natural processes, including erosion and succession. For sub-sites mapped: Bartraw - 0.04ha and Rosmurrevagh - 0.08ha. See map 7	Current area unknown. Two sub-sites (Bartraw and Rosmurrevagh) were mapped during the Coastal Monitoring Project (Ryle et al., 2009), giving a total estimated area of 0.12ha. NB further unsurveyed areas maybe present in the site. Habitat is very difficult to measure in view of its dynamic nature which means that it can appear and disappear within a site from year to year. See coastal habitats supporting document for further details
Habitat distribution	Occurrence	No decline, subject to natural processes	Current distribution unknown. Majority of habitat found at Bartraw and Rosmurrevagh, although there may be additional patches distributed throughout the site. See coastal habitats supporting document for further details
Physical structure: functionality and sediment supply	Presence/absence of physical barriers	Maintain the natural circulation of sediment and organic matter, without any physical obstructions	Dunes are naturally dynamic systems that require continuous supply and circulation of sand. Accumulation of organic matter in tidal litter is essential for trapping sand and initiating dune formation. Physical barriers can lead to fossilisation or over-stabilisation of dunes, as well as beach starvation resulting in increased rates of erosion. See coastal habitats supporting document for further details
Vegetation structure: zonation	Occurrence	Maintain the range of coastal habitats including transitional zones, subject to natural processes including erosion and succession	Based on data from Ryle et al. (2009). See coastal habitats supporting document for further details
Vegetation composition: typical species and sub-communities	Percentage cover at a representative number of monitoring stops	Maintain the presence of species-poor communities with typical species: *Cakile maritima, Honckenya peploides*, *Salsola kali* and *Atriplex* spp.	Based on data from Ryle et al. (2009) . See coastal habitats supporting document for further details
Vegetation composition: negative indicator species	Percentage cover	Negative indicator species (including non-natives) to represent less than 5% cover	Negative indicators include non-native species, species indicative of changes in nutrient status and species not considered characteristic of the habitat. Based on data from Ryle et al. (2009). See coastal habitats supporting document for further details

1220 Perennial vegetation of stony banks

To maintain the favourable conservation condition of Perennial vegetation of stony banks in Clew Bay Complex SAC, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Habitat area	Hectares	Area stable or increasing, subject to natural processes, including erosion and succession	Current area unknown, but Clew Bay is considered to have the largest shingle reserves in the country. It was recorded from Clew Bay Complex, Bartraw and Rosmurrevagh during the National Shingle Beach Survey (Moore and Wilson, 1999), but the extent was not mapped. The Coastal Monitoring Project mapped 0.48ha of this habitat at Bartraw and 0.01ha at Rosmurrevagh (Ryle et al., 2009). The extent is considerably greater than this figure, as substantial shingle deposits are known to occur in association with many of the drumlins in Clew Bay. See coastal habitats supporting document for further details
Habitat distribution	Occurrence	No decline, subject to natural processes	Distribution unknown at present, although the habitat has been recorded at Clew Bay Complex (Moore and Wilson, 1999), as well as Bartraw and Rosmurrevagh (Moore and Wilson, 1999; Ryle et al., 2009). See coastal habitats supporting document for further details
Physical structure: Functionality and sediment supply	Presence/absence of physical barriers	Maintain the natural circulation of sediment and organic matter, without any physical obstructions	Site represents the only known example of incipient gravel barrier formation in the country. See coastal habitats supporting document for further details
Vegetation structure: zonation	Occurrence	Maintain the range of coastal habitats including transitional zones, subject to natural processes including erosion and succession	Based on data from Moore and Wilson (1999) and Ryle et al. (2009). See coastal habitats supporting document for further details
Vegetation composition: typical species and sub-communities	Percentage cover at a representative sample of monitoring stops	Maintain the presence of species-poor communities with typical species: *Honckenya peploides*, *Beta vulgaris* ssp. *maritima*, *Crithmum maritimum*, *Tripleurospermum maritimum*, *Glaucium flavum* and *Silene uniflora*	Based on data from Moore and Wilson (1999) and Ryle et al. (2009). See coastal habitats supporting document for further details
Vegetation composition: negative indicator species	Percentage cover	Negative indicator species (including non-natives) to represent less than 5% cover	Based on data from Moore and Wilson (1999) and Ryle et al. (2009). Negative indicators include non-native species, species indicative of changes in nutrient status and species not considered characteristic of the habitat. See coastal habitats supporting document for further details

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

To restore the favourable conservation condition of Atlantic salt meadows in Clew Bay Complex SAC, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Habitat area	Hectares	Area stable or increasing, subject to natural processes, including erosion and succession. For sub-sites mapped: Mallaranny - 19.76ha, Tooreen - 1.06ha, Rosmurrevagh - 6.40ha, Tierna - 0.39ha, Rockfleet Castle - 0.37ha, Rosharnagh East - 0.03ha, Caraholly - 0.36ha, Kiladangan - 0.96ha, Annagh Island - 5.23ha, Bartraw - 0.38ha. See map 6	Based on data from the Saltmarsh Monitoring Project (McCorry, 2007). Ten sub-sites were mapped (34.94ha) and additional areas of potential saltmarsh (3.92ha) were identified for an examination of aerial photographs, giving a total estimated area of 38.86ha. NB further unsurveyed areas maybe present within the site. See coastal habitats supporting document for further details
Habitat distribution	Occurrence	No decline, subject to natural processes. See map 6 for known distribution	Based on data from McCorry (2007). See coastal habitats supporting document for further details
Physical structure: sediment supply	Presence/absence of physical barriers	Maintain/restore natural circulation of sediments and organic matter, without any physical obstructions	See coastal habitats backing document for further details
Physical structure: creeks and pans	Occurrence	Maintain creek and pan structure, subject to natural processes, including erosion and succession	Based on data from McCorry (2007). The efficiency of sediment circulation throughout a saltmarsh depends on the creek pattern. See coastal habitats supporting document for further details
Physical structure: flooding regime	Hectares flooded; frequency	Maintain natural tidal regime	See coastal habitats supporting document for further details
Vegetation structure: zonation	Occurrence	Maintain the range of coastal habitats including transitional zones, subject to natural processes including erosion and succession	Based on data from McCorry and Ryle (2009). See coastal habitats supporting document for further details
Vegetation structure: vegetation height	Centimetres	Maintain structural variation within sward	Based on data from McCorry (2007). See coastal habitats supporting document for further details
Vegetation structure: vegetation cover	Percentage cover at a representative sample of monitoring stops	Maintain more than 90% area outside creeks vegetated.	Based on data from McCorry (2007). See coastal habitats supporting document for further details
Vegetation composition: typical species and sub-communities	Percentage cover at a representative sample of monitoring stops	Maintain range of sub-communities with typical species listed in Saltmarsh Monitoring Project (McCorry & Ryle, 2009)	Based on data from McCorry (2007). See coastal habitats supporting document for further details

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

To restore the favourable conservation condition of Atlantic salt meadows in Clew Bay Complex SAC, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Vegetation structure: negative indicator species - *Spartina anglica*	Hectares	No significant expansion of *Spartina*. No new sites for this species and an annual spread of less than 1% where it is already known to occur	Based on data from McCorry (2007). See coastal habitats supporting document for further details

1355 Otter *Lutra lutra*

To restore the favourable conservation condition of Otter in Clew Bay Complex SAC, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Distribution	Percentage positive survey sites	No significant decline	Measure based on standard otter survey technique. FCS target, based on 1980/81 survey findings, is 88% in SACs. Current range in west estimated at 70% (Bailey and Rochford, 2006)
Extent of terrestrial habitat	Hectares	No significant decline. Area mapped and calculated as 233.1ha above high water mark (HWM); 47.3ha along river banks/ around ponds	No field survey. Areas mapped to include 10m terrestrial buffer along shoreline (above HWM and along river banks) identified as critical for otters (NPWS, 2007)
Extent of marine habitat	Hectares	No significant decline. Area mapped and calculated as 2426.7ha	No field survey. Area mapped based on evidence that otters tend to forage within 80m of the shoreline (HWM) (NPWS, 2007; Kruuk, 2006)
Extent of freshwater (river) habitat	Kilometres	No significant decline. Length mapped and calculated as 10.2km	No field survey. River length calculated on the basis that otters will utilise freshwater habitats from estuary to headwaters (Chapman and Chapman, 1982)
Extent of freshwater (lake/lagoon) habitat	Hectares	No significant decline. Area mapped and calculated as 141.3ha	No field survey. Area mapped based on evidence that otters tend to forage within 80m of the shoreline (NPWS, 2007)
Couching sites and holts	Number	No significant decline	Otters need lying up areas throughout their territory where they are secure from disturbance (Kruuk, 2006; Kruuk and Moorhouse, 1991)
Fish biomass available	Kilograms	No significant decline	Broad diet that varies locally and seasonally, but dominated by fish, in particular salmonids, eels and sticklebacks in freshwater (Bailey and Rochford, 2006) and wrasse and rockling in coastal waters (Kingston et al., 1999)
Barriers to connectivity	Number	No significant increase. For guidance, see map 8	Otters will regularly commute across stretches of open water up to 500m. e.g. between the mainland and an island; between two islands; across an estuary (De Jongh and O'Neill, 2010). It is important that such commuting routes are not obstructed

1365 Common seal *Phoca vitulina*

To maintain the favourable conservation condition of Harbour seal in Clew Bay Complex SAC, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Access to suitable habitat	Number of artificial barriers	Species range within the site should not be restricted by artificial barriers to site use	See marine supporting document for further details
Breeding behaviour	Breeding sites	The breeding sites should be maintained in a natural condition. See map 9	Attribute and target based on background knowledge of Irish breeding populations, review of data from Lyons (2004) and unpublished National Parks and Wildlife Service records. See marine supporting document for further details
Moulting behaviour	Moult haul-out sites	The moult haul-out sites should be maintained in a natural condition. See map 9	Attribute and target based on background knowledge of Irish populations, review of data from Lyons (2004), Cronin et al. (2004) and unpublished National Parks and Wildlife Service records. See marine supporting document for further details
Resting behaviour	Resting haul-out sites	The resting haul-out sites should be maintained in a natural condition. See map 9	Attribute and target based on background knowledge of Irish populations, review of data from Lyons (2004) and unpublished National Parks and Wildlife Service records. See marine supporting document for further details
Disturbance	Level of impact	Human activities should occur at levels that do not adversely affect the harbour seal population at the site	See marine supporting document for further details

2110 Embryonic shifting dunes

To restore the favourable conservation condition of Embryonic shifting dunes in Clew Bay Complex SAC, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Habitat area	Hectares	Area stable or increasing, subject to natural processes, including erosion and succession. For sub-sites mapped: Bartraw - 0.02ha and Rosmurrevagh - 1.38ha. See map 7	Current area unknown. Two sub-sites (Bartraw and Rosmurrevagh) were mapped during the Coastal Monitoring Project (Ryle et al., 2009), giving a total estimated area of 1.40ha. NB further unsurveyed areas maybe present in the site. Habitat is very difficult to measure in view of its dynamic nature. See coastal habitats supporting document for further details
Habitat distribution	Occurrence	No decline, subject to natural processes. See map 7 for known distribution	Mobile dunes are well developed at Rosmurrevagh, while those at Bartraw have been compromised by the installation of coastal protection works. See coastal habitats supporting document for further details
Physical structure: functionality and sediment supply	Presence/absence of physical barriers	Maintain the natural circulation of sediment and organic matter, without any physical obstructions	Dunes are naturally dynamic systems that require continuous supply and circulation of sand. Physical barriers can lead to fossilisation or over-stabilisation of dunes, as well as beach starvation resulting in increased rates of erosion. See coastal habitats supporting document for further details
Vegetation structure: zonation	Occurrence	Maintain the range of coastal habitats including transitional zones, subject to natural processes including erosion and succession	Based on data from Ryle et al. (2009). See coastal habitats supporting document for further details
Vegetation composition: plant health of foredune grasses	Percentage cover	More than 95% of *Elytrigia* and/or *Leymus* should be healthy (i.e. green plant parts above ground and flowering heads present)	Based on data from Ryle et al. (2009). See coastal habitats supporting document for further details
Vegetation composition: typical species and sub-communities	Percentage cover	Maintain the presence of species-poor communities with typical species: *Elytrigia juncea* and/or *Leymus arenarius*	Based on data from Ryle et al. (2009). See coastal habitats supporting document for further details
Vegetation composition: negative indicator species	Percentage cover	Negative indicator species (including non-natives) to represent less than 5% cover	Based on data from Ryle et al. (2009). Negative indicators include non-native species, species indicative of changes in nutrient status and species not considered characteristic of the habitat. Sea-buckthorn (Hippophae rhamnoides) should be absent or effectively controlled. See coastal habitats supporting document for further details

2120 Shifting dunes along the shoreline with *Ammophila arenaria* ("white dunes")

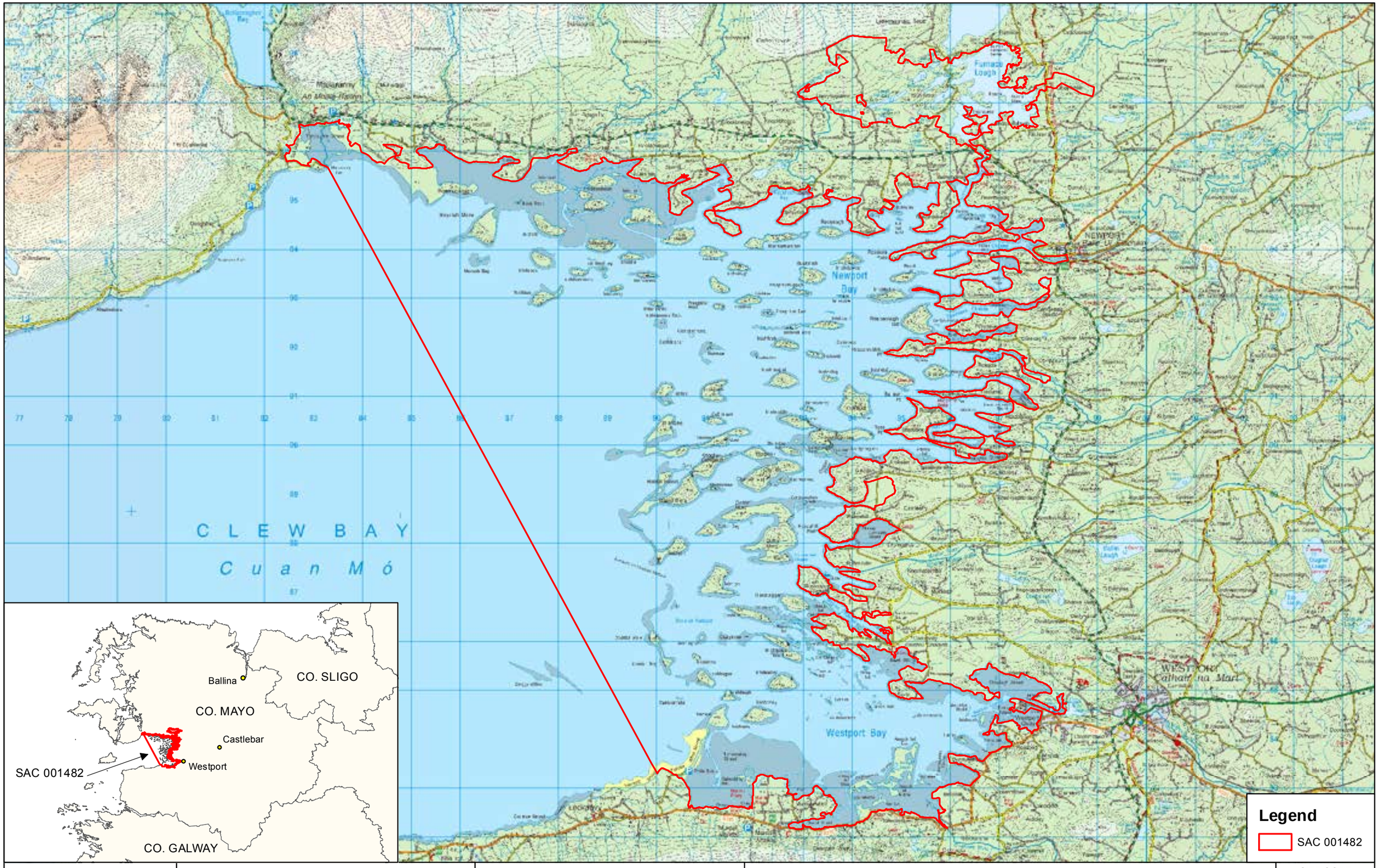
To restore the favourable conservation condition of Shifting dunes along the shoreline with Ammophila arenaria in Clew Bay Complex SAC, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Habitat area	Hectares	Area stable or increasing, subject to natural processes including erosion and succession. For sub-sites mapped: Bartraw - 0.18ha and Rosmurrevagh - 0.36ha. See map 7	Current area unknown. Two sub-sites (Bartraw and Rosmurrevagh) were mapped during the Coastal Monitoring Project (Ryle et al., 2009), giving a total estimated area of 0.54ha. NB further unsurveyed areas maybe present in the site. Habitat is very difficult to measure in view of its dynamic nature. See coastal habitats supporting document for further details
Habitat distribution	Occurrence	No decline, subject to natural processes. See map 7 for known distribution	Mobile dunes are well developed at Rosmurrevagh, while those at Bartraw have been compromised by the installation of coastal protection works. See coastal habitats supporting document for further details
Physical structure: functionality and sediment supply	Presence/absence of physical barriers	Maintain the natural circulation of sediment and organic matter, without any physical obstructions	Dunes are naturally dynamic systems that require continuous supply and circulation of sand. *Ammophila* reproduces vegetatively and requires constant accretion of fresh sand to maintain active growth encouraging further accretion. Physical barriers can lead to fossilisation or over-stabilisation of dunes, as well as beach starvation resulting in increased rates of erosion. See coastal habitats supporting document for further details
Vegetation structure: zonation	Occurrence	Maintain the range of coastal habitats including transitional zones, subject to natural processes including erosion and succession	Based on data from Gaynor (2008) and Ryle et al. (2009). See coastal habitats supporting document for further details
Vegetation composition: plant health of dune grasses	Percentage cover	More than 95% of *Ammophila* and/or *Leymus* should be healthy (i.e. green plant parts above ground and flowering heads present)	Based on data from Ryle et al. (2009). See coastal habitats supporting document for further details
Vegetation composition: typical species and sub-communities	Percentage cover at a representative number of monitoring stops	Maintain the presence of species-poor communities dominated by *Ammophila arenaria* and/or *Leymus arenarius*	Based on data from Gaynor (2008) and Ryle et al. (2009). See coastal habitats supporting document for further details

2120 Shifting dunes along the shoreline with *Ammophila arenaria* ("white dunes")

To restore the favourable conservation condition of Shifting dunes along the shoreline with Ammophila arenaria in Clew Bay Complex SAC, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Vegetation composition: negative indicator species	Percentage cover	Negative indicator species (including non-natives) to represent less than 5% cover	Based on data from Ryle et al. (2009). Negative indicators include non-native species, species indicative of changes in nutrient status and species not considered characteristic of the habitat. Sea-buckthorn (*Hippophae rhamnoides*) should be absent or effectively controlled. See coastal habitats supporting document for further details



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Department of Arts, Heritage and the Gaeltacht

MAP 1: CLEW BAY COMPLEX CONSERVATION OBJECTIVES SAC DESIGNATION

Map to be read in conjunction with the NPWS Conservation Objectives Document.

COUNTY MAYO

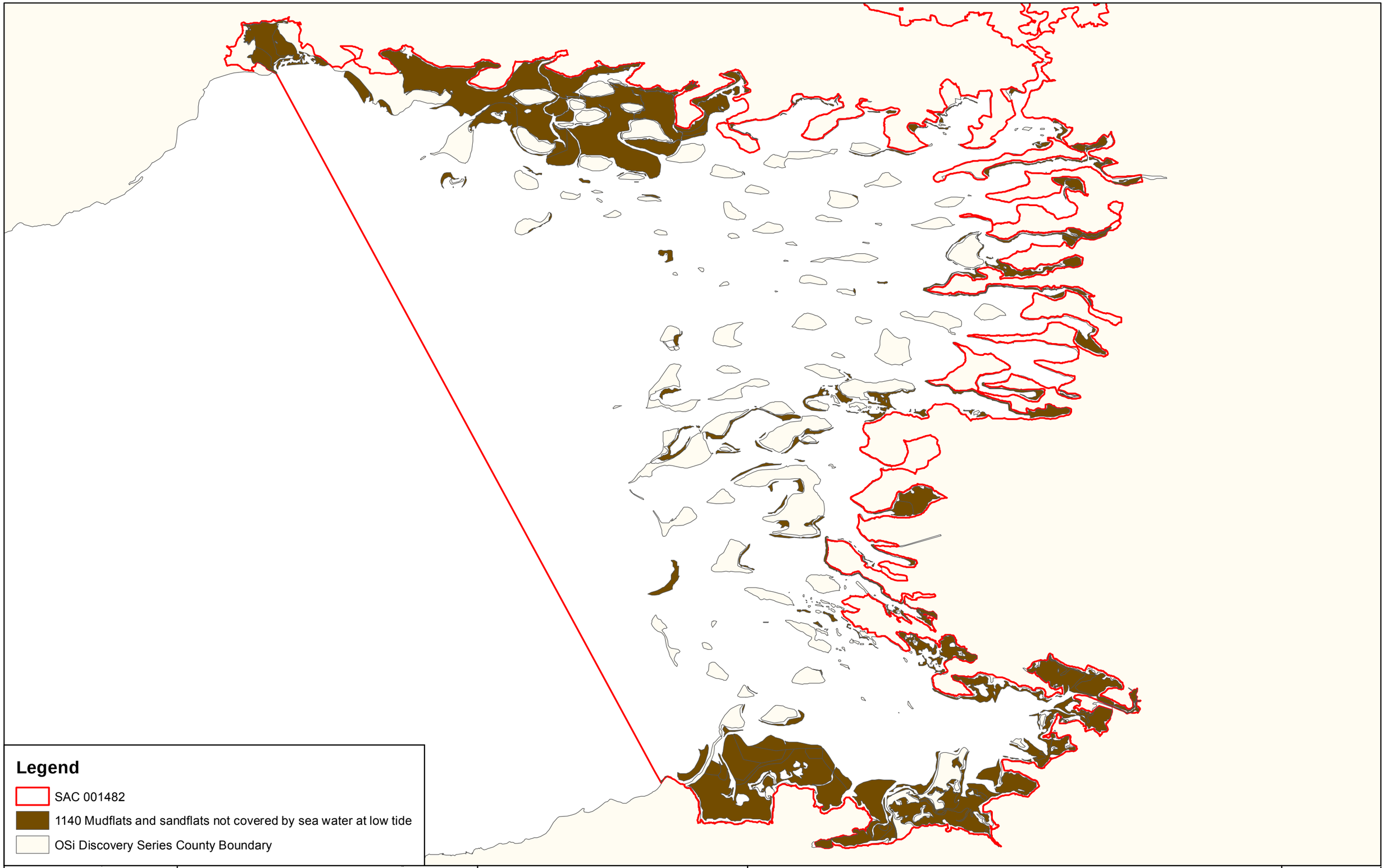
0 1 2 3 4 km

N

SITE CODE

SAC 001482
Version 1.05

Map Version 1
Date: June 2011



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Department of
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MAP 2:
CLEW BAY COMPLEX
CONSERVATION OBJECTIVES
TIDAL MUDFLATS AND SANDFLATS

Map to be read in conjunction with the NPWS Conservation Objectives Document.

COUNTY MAYO

0 1 2 3 km

N

SITE CODE

SAC 001482
Version 1.05

Map Version 1
Date: June 2011

Legend

- SAC 001482
- 1160 Large shallow inlets and bays
- OSi Discovery Series County Boundary

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MAP 3:
CLEW BAY COMPLEX
CONSERVATION OBJECTIVES
LARGE SHALLOW INLETS AND BAYS

Map to be read in conjunction with the NPWS Conservation Objectives Document.

COUNTY MAYO

0 1 2 3 km

N

SITE CODE

SAC 001482
Version 1.05

Map Version 1
Date: June 2011

Legend

- SAC 001482
- OSi Discovery Series County Boundary

Marine Community Types

- Fine sand dominated by *Nephtys cirrosa* community
- Intertidal sandy mud with *Tubificoides benedii* and *Pygospio elegans* community complex
- Maerl dominated community
- Reef
- Sandy mud with polychaetes and bivalves community complex
- Shingle
- *Zostera* community

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MAP 4:
CLEW BAY COMPLEX
CONSERVATION OBJECTIVES
MARINE COMMUNITY TYPES

Map to be read in conjunction with the NPWS Conservation Objectives Document.

COUNTY MAYO

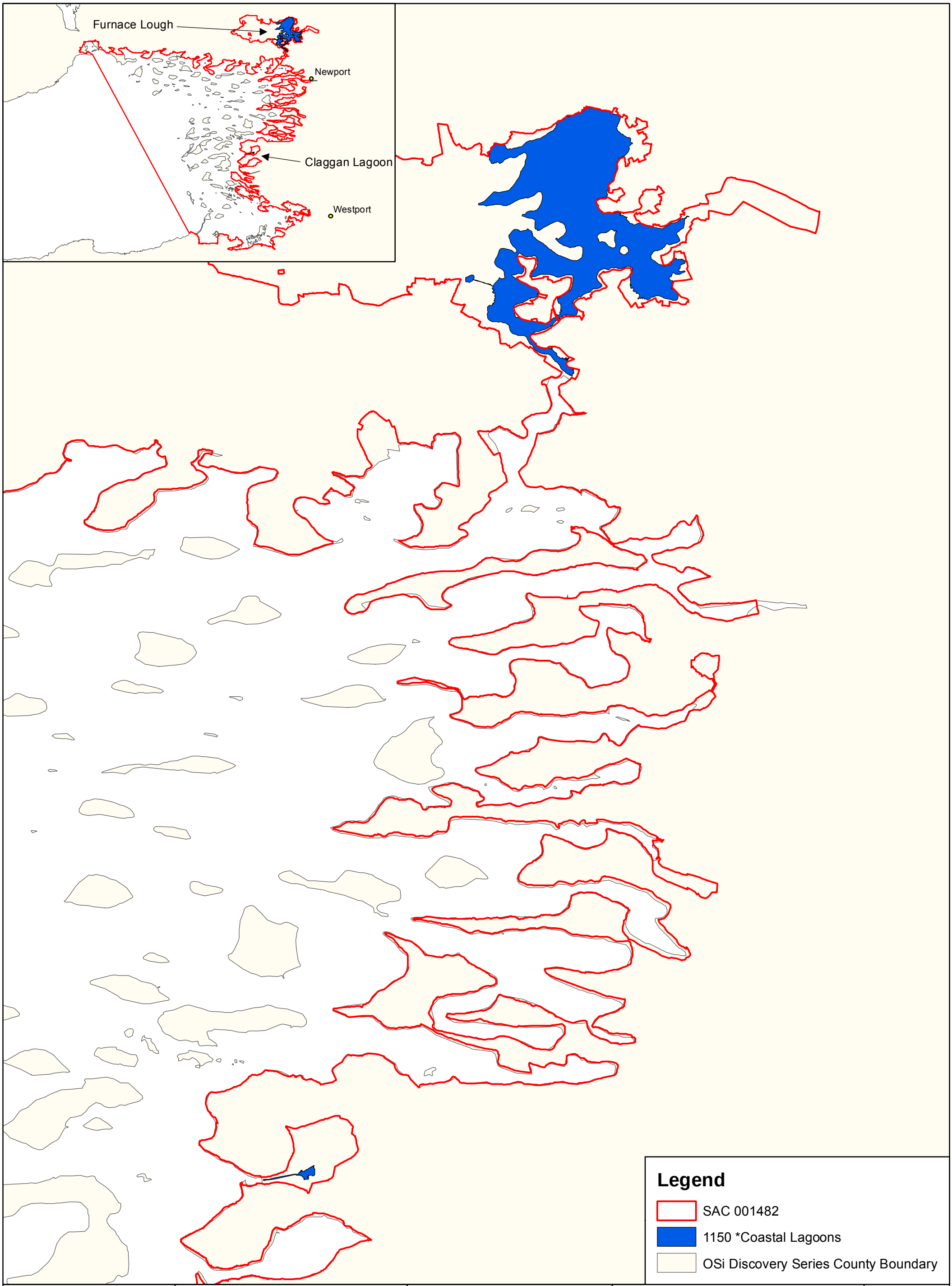
0 1 2 3 km

N

SITE CODE

SAC 001482
Version 1.05

Map Version 1
Date: June 2011



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MAP 5: CLEW BAY COMPLEX CONSERVATION OBJECTIVES COASTAL LAGOONS

Map to be read in conjunction with the NPWS Conservation Objectives Document.

COUNTY MAYO

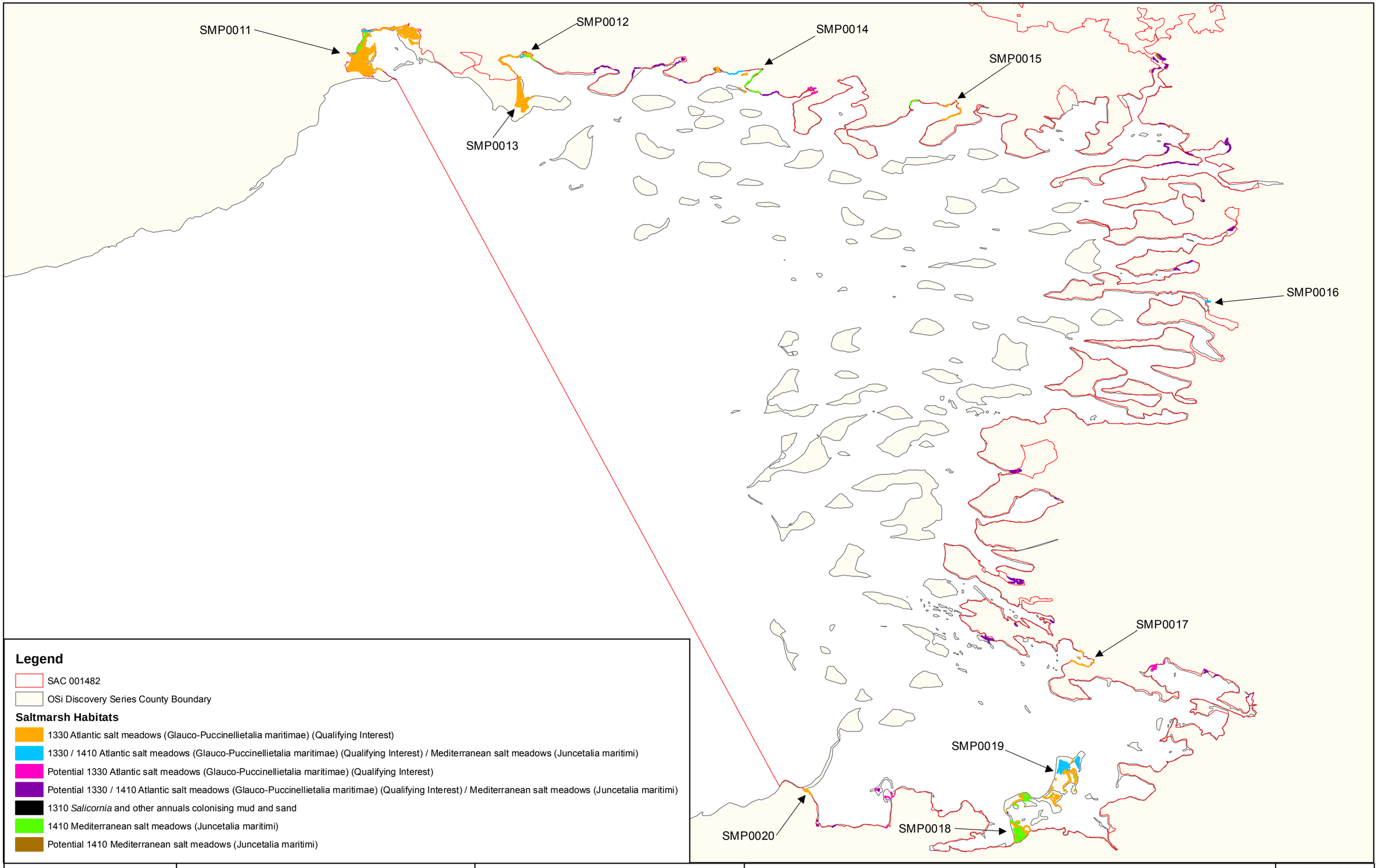
0 0.5 1 km

N

SITE CODE

SAC 001482
Version 1.05

Map Version 1
Date: June 2011



Legend

SAC 001482

OSi Discovery Series County Boundary

Saltmarsh Habitats

- 1330 Atlantic salt meadows (Glauco-Puccinellietalia maritimae) (Qualifying Interest)
- 1330 / 1410 Atlantic salt meadows (Glauco-Puccinellietalia maritimae) (Qualifying Interest) / Mediterranean salt meadows (Juncetalia maritimi)
- Potential 1330 Atlantic salt meadows (Glauco-Puccinellietalia maritimae) (Qualifying Interest)
- Potential 1330 / 1410 Atlantic salt meadows (Glauco-Puccinellietalia maritimae) (Qualifying Interest) / Mediterranean salt meadows (Juncetalia maritimi)
- 1310 *Salicornia* and other annuals colonising mud and sand
- 1410 Mediterranean salt meadows (Juncetalia maritimi)
- Potential 1410 Mediterranean salt meadows (Juncetalia maritimi)

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MAP 6: CLEW BAY COMPLEX CONSERVATION OBJECTIVES SALTMARSH HABITATS

Map to be read in conjunction with the NPWS Conservation Objectives Document.

COUNTY MAYO

0 1 2 3 km

N

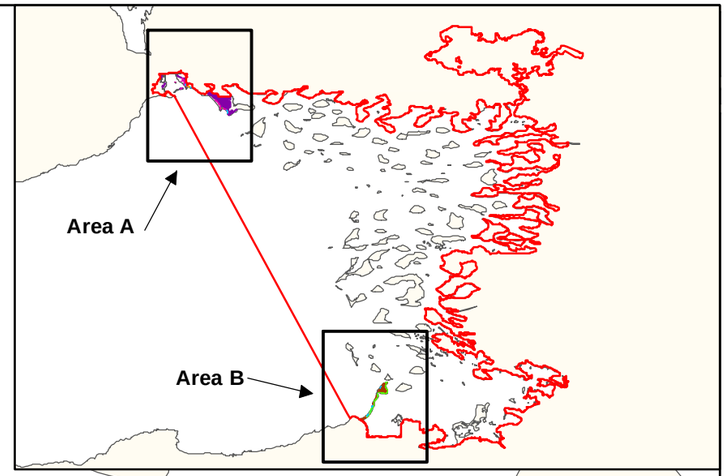
SITE CODE

SAC 001482
Version 1.05

Map Version 1
Date: June 2011

Area A

Area B



CMP SITE:111

CMP SITE:112

Legend

- SAC 001482
- OSi Discovery Series County Boundary

Coastal Habitats

- 1210 Annual vegetation of drift lines (Qualifying Interest)
- 1220 Perennial vegetation of stony banks (Qualifying Interest)
- 2110 Embryonic shifting dunes (Qualifying Interest)
- 2120 Shifting dunes along the shoreline with *Ammophila arenaria* ('white dunes') (Qualifying Interest)
- 21AO Machairs (*in Ireland)
- 2130 *Fixed coastal dunes with herbaceous vegetation ('grey dunes')

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MAP 7:
CLEW BAY COMPLEX
CONSERVATION OBJECTIVES
COASTAL HABITATS

Map to be read in conjunction with the NPWS Conservation Objectives Document.

COUNTY MAYO

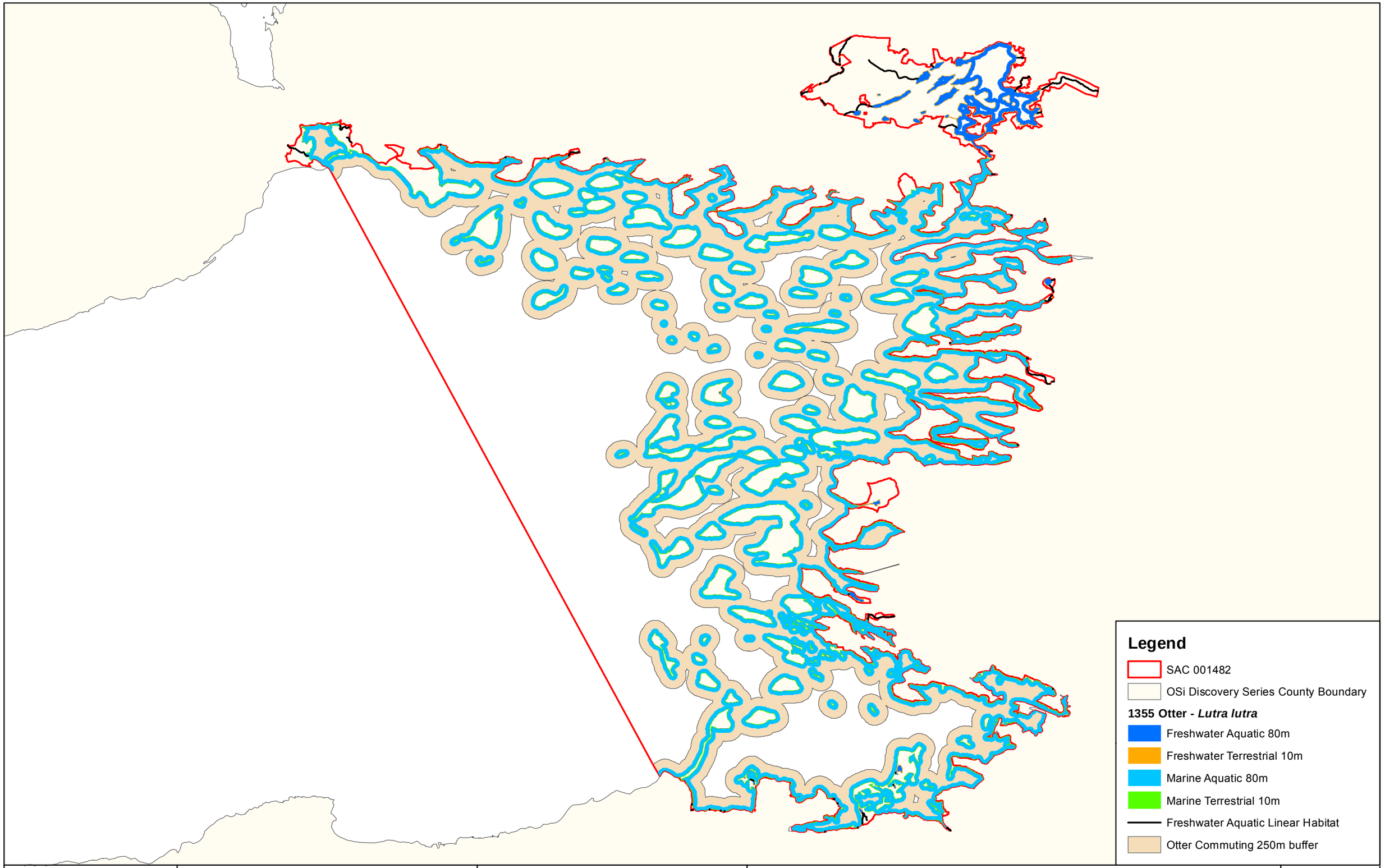
0 0.25 0.5 0.75 1 km

N

SITE CODE

SAC 001482
Version 1.05

Map Version 1
Date: June 2011



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MAP 8: CLEW BAY COMPLEX CONSERVATION OBJECTIVES OTTER

Map to be read in conjunction with the NPWS Conservation Objectives Document.

COUNTY MAYO

0 1 2 3 4 km

N

SITE CODE

SAC 001482
Version 1.05

Map Version 1
Date: June 2011

Legend

- SAC 001482
- 1365 Common (Harbour) Seal - *Phoca vitulina* Breeding Sites
- 1365 Common (Harbour) Seal - *Phoca vitulina* Moulting Sites
- 1365 Common (Harbour) Seal - *Phoca vitulina* Resting Sites
- 1365 Common (Harbour) Seal - *Phoca vitulina* Habitat
- OSi Discovery Series County Boundary

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MAP 9:
CLEW BAY COMPLEX
CONSERVATION OBJECTIVES
COMMON HARBOUR SEAL

Map to be read in conjunction with the NPWS Conservation Objectives Document.

COUNTY MAYO

0 1 2 3 km

N

SITE CODE

SAC 001482
Version 1.05

Map Version 1
Date: June 2011

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Department of
Arts, Heritage and the Gaeltacht

Produced by: National Parks and Wildlife Service,
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E-mail: natureconservation@environ.ie

Citation:
NPWS (2011) Conservation Objectives: Clew Bay Complex SAC 001482. Version 1.0. National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht.

Series Editors: Rebecca Jeffrey & Naomi Kingston
ISSN 2009-4086

Conservation objectives for Newport River SAC [002144]

The overall aim of the Habitats Directive is to maintain or restore the favourable conservation status of habitats and species of community interest. These habitats and species are listed in the Habitats and Birds Directives and Special Areas of Conservation and Special Protection Areas are designated to afford protection to the most vulnerable of them. These two designations are collectively known as the Natura 2000 network.

European and national legislation places a collective obligation on Ireland and its citizens to maintain habitats and species in the Natura 2000 network at favourable conservation condition. The Government and its agencies are responsible for the implementation and enforcement of regulations that will ensure the ecological integrity of these sites.

The maintenance of habitats and species within Natura 2000 sites at favourable conservation condition will contribute to the overall maintenance of favourable conservation status of those habitats and species at a national level.

Favourable conservation status of a habitat is achieved when:

- its natural range, and area it covers within that range, are stable or increasing, and
- 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.

The 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, and
- 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.

Objective: To maintain or restore the favourable conservation condition of the Annex I habitat(s) and/or the Annex II species for which the SAC has been selected:

ADD HABITATS

Code	Common Name	Scientific Name
1029	Freshwater Pearl Mussel	*Margaritifera margaritifera*
1106	Salmon	*Salmo salar*

Citation: *NPWS (2018) Conservation objectives for Newport River SAC [002144]. Generic Version 6.0. Department of Culture, Heritage and the Gaeltacht.*

ISSN 2009-4086

National Parks and Wildlife Service

Conservation Objectives Series

River Moy SAC 002298

An Roinn Ealaíon, Oidhreachta,
Gnóthaí Réigiúnacha, Tuaithe agus Gaeltachta

Department of Arts, Heritage,
Regional, Rural and Gaeltacht Affairs

National Parks and Wildlife Service,
Department of Arts, Heritage, Regional, Rural and Gaeltacht Affairs,

7 Ely Place, Dublin 2, Ireland.

Web: www.npws.ie
E-mail: nature.conservation@ahg.gov.ie

Citation:

NPWS (2016) Conservation Objectives: River Moy SAC 002298. Version 1. National Parks and Wildlife Service, Department of Arts, Heritage, Regional, Rural and Gaeltacht Affairs.

Series Editor: Rebecca Jeffrey
ISSN 2009-4086

Introduction

The overall aim of the Habitats Directive is to maintain or restore the favourable conservation status of habitats and species of community interest. These habitats and species are listed in the Habitats and Birds Directives and Special Areas of Conservation and Special Protection Areas are designated to afford protection to the most vulnerable of them. These two designations are collectively known as the Natura 2000 network.

European and national legislation places a collective obligation on Ireland and its citizens to maintain habitats and species in the Natura 2000 network at favourable conservation condition. The Government and its agencies are responsible for the implementation and enforcement of regulations that will ensure the ecological integrity of these sites.

A site-specific conservation objective aims to define favourable conservation condition for a particular habitat or species at that site.

The maintenance of habitats and species within Natura 2000 sites at favourable conservation condition will contribute to the overall maintenance of favourable conservation status of those habitats and species at a national level.

Favourable conservation status of a habitat is achieved when:

- its natural range, and area it covers within that range, are stable or increasing, and
- 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.

The 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, and
- 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.

Notes/Guidelines:

1. The targets given in these conservation objectives are based on best available information at the time of writing. As more information becomes available, targets for attributes may change. These will be updated periodically, as necessary.
2. An appropriate assessment based on these conservation objectives will remain valid even if the targets are subsequently updated, providing they were the most recent objectives available when the assessment was carried out. It is essential that the date and version are included when objectives are cited.
3. Assessments cannot consider an attribute in isolation from the others listed for that habitat or species, or for other habitats and species listed for that site. A plan or project with an apparently small impact on one attribute may have a significant impact on another.
4. Please note that the maps included in this document do not necessarily show the entire extent of the habitats and species for which the site is listed. This should be borne in mind when appropriate assessments are being carried out.
5. When using these objectives, it is essential that the relevant backing/supporting documents are consulted, particularly where instructed in the targets or notes for a particular attribute.

Qualifying Interests

**** indicates a priority habitat under the Habitats Directive***

002298	River Moy SAC
1092	White-clawed Crayfish *Austropotamobius pallipes*
1095	Sea Lamprey *Petromyzon marinus*
1096	Brook Lamprey *Lampetra planeri*
1106	Salmon *Salmo salar*
1355	Otter *Lutra lutra*
7110	Active raised bogs*
7120	Degraded raised bogs still capable of natural regeneration
7150	Depressions on peat substrates of the Rhynchosporion
7230	Alkaline fens
91A0	Old sessile oak woods with *Ilex* and *Blechnum* in the British Isles
91E0	Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (Alno-Padion, Alnion incanae, Salicion albae)*

Please note that this SAC overlaps with Killala Bay/Moy Estuary SPA (004036) and Lough Conn and Lough Cullin SPA (004228). It is adjacent to Killala Bay/Moy Estuary SAC (000458), Lough Hoe Bog SAC (000633), Bellacorick Bog Complex SAC (001922) and Ox Mountains Bogs SAC (002006). See map 2. The conservation objectives for this site should be used in conjunction with those for overlapping and adjacent sites as appropriate.

Supporting documents, relevant reports & publications

Supporting documents, NPWS reports and publications are available for download from: www.npws.ie/Publications

NPWS Documents

Year :	1998
Title :	Conservation management of the white-clawed crayfish, (*Austropotamobius pallipes*)
Author :	Reynolds, J.D.
Series :	Irish Wildlife Manual No. 1
Year :	2004
Title :	The status and distribution of lamprey and shad in the Slaney and Munster Blackwater SACs
Author :	King, J.J.; Linnane, S.M.
Series :	Irish Wildlife Manuals No. 14
Year :	2004
Title :	A survey of juvenile lamprey populations in the Moy catchment
Author :	O'Connor, W.
Series :	Irish Wildlife Manuals No. 15
Year :	2006
Title :	Otter survey of Ireland 2004/2005
Author :	Bailey, M.; Rochford, J.
Series :	Irish Wildlife Manual No. 23
Year :	2006
Title :	Assessment of impacts of turf cutting on designated raised bogs
Author :	Fernandez Valverde, F.; MacGowan, F.; Farrell, M.; Crowley, W.; Croal, Y.; Fanning, M.; McKee, A-M.
Series :	Unpublished report to NPWS
Year :	2007
Title :	Supporting documentation for the Habitats Directive Conservation Status Assessment - backing documents. Article 17 forms and supporting maps
Author :	NPWS
Series :	Unpublished report to NPWS
Year :	2008
Title :	National survey of native woodlands 2003-2008
Author :	Perrin, P.M.; Martin, J.; Barron, S.; O'Neill, F.H.; McNutt, K.E.; Delaney, A.
Series :	Unpublished Report to NPWS
Year :	2010
Title :	A provisional inventory of ancient and long-established woodland in Ireland
Author :	Perrin, P.M.; Daly, O.H.
Series :	Irish Wildlife Manual No. 46
Year :	2010
Title :	A technical manual for monitoring white-clawed crayfish (*Austropotamobius pallipes*) in Irish lakes
Author :	Reynolds, J., O'Connor, W., O'Keeffe, C.; Lynn, D.
Series :	Irish Wildlife Manual No.45
Year :	2012
Title :	Killala Bay/Moy Estuary SAC (00458) Coastal Supporting doc V1
Author :	NPWS
Series :	Conservation objectives supporting document

Year :	2012
Title :	Killala Bay/Moy Estuary SAC (000458) Marine supporting doc v.1
Author :	NPWS
Series :	Conservation objectives supporting document
Year :	2013
Title :	National otter survey of Ireland 2010/12
Author :	Reid, N.; Hayden, B.; Lundy, M.G.; Pietravalle, S.; McDonald, R.A.; Montgomery, W.I.
Series :	Irish Wildlife Manual No. 76
Year :	2014
Title :	Guidelines for a national survey and conservation assessment of upland vegetation and habitats in Ireland, Version 2.0
Author :	Perrin, P.M.; Barron, S.J.; Roche, J.R.; O'Hanrahan, B.
Series :	Irish Wildlife Manual No. 79
Year :	2014
Title :	Raised Bog Monitoring and Assessment Survey 2013
Author :	Fernandez, F.; Connolly K.; Crowley W.; Denyer J.; Duff K.; Smith G.
Series :	Irish Wildlife Manual No. 81
Year :	2014
Title :	National raised bog SAC management plan
Author :	Department of Arts, Heritage and the Gaeltacht
Series :	Draft for consultation. 15 January 2014
Year :	2014
Title :	Derrynabrock Bog (SAC 002298), Co.Roscommon/Mayo, Site Report
Author :	Fernandez, F.; Connolly, K.; Crowley, W.; Denyer J.; Duff K.; Smith G.
Series :	Raised bog monitoring and assessment survey 2013
Year :	2014
Title :	Tawnaghbeg Bog (SAC 002298), Co. Mayo, Site Report
Author :	Fernandez, F.; Connolly, K.; Crowley, W.; Denyer J.; Duff K.; Smith G.
Series :	Raised bog monitoring and assessment survey 2013
Year :	2016
Title :	River Moy SAC (site code: 2298) Conservation objectives supporting document- raised bog habitats V1
Author :	NPWS
Series :	Conservation objectives supporting document

Other References

Year :	1982
Title :	Otter survey of Ireland
Author :	Chapman, P.J.; Chapman, L.L.
Series :	Unpublished report to Vincent Wildlife Trust
Year :	2002
Title :	Reversing the habitat fragmentation of British woodlands
Author :	Peterken, G.
Series :	WWF-UK, London

Year :	2003
Title :	Monitoring the river, sea and brook lamprey, *Lampetra fluviatilis*, *L. planeri* and *Petromyzon marinus*
Author :	Harvey, J.; Cowx, I.
Series :	Conserving Natura 2000 Rivers Monitoring Series No. 5. English Nature, Peterborough
Year :	2003
Title :	Identifying lamprey. A field key for sea, river and brook lamprey
Author :	Gardiner, R.
Series :	Conserving Natura 2000 rivers, Conservation techniques No. 4. English Nature, Peterborough
Year :	2007
Title :	Evolutionary history of lamprey paired species *Lampetra fluviatilis* L. and *Lampetra planeri* Bloch as inferred from mitochondrial DNA variation
Author :	Espanhol, R.; Almeida, P.R.; Alves, M.J.
Series :	Molecular Ecology 16, 1909-1924
Year :	2010
Title :	Otter tracking study of Roaringwater Bay
Author :	De Jongh, A.; O'Neill, L.
Series :	Unpublished draft report to NPWS
Year :	2015
Title :	Behaviour of sea lamprey (*Petromyzon marinus* L.) at man-made obstacles during upriver spawning migration: use of telemetry to access efficacy of weir modifications for improved passage
Author :	Rooney, S.M.; Wightman, G.D.; O Conchuir, R.; King, J.J.
Series :	Biology and Environment: Proc. R. Ir. Acad. 115 B, 1-12
Year :	2015
Title :	River engineering works and lamprey ammocoetes; impacts, recovery, mitigation
Author :	King, J.J.; Wightman, G.D.; Hanna, G.; Gilligan, N.
Series :	Water and Environment Journal, 29, 482-488
Year :	2016
Title :	The status of Irish salmon stocks in 2015 with precautionary catch advice for 2016
Author :	Standing Scientific Committee on Salmon
Series :	Independent scientific report to Inland Fisheries Ireland

Spatial data sources

Year :	2014
Title :	Scientific Basis for Raised Bog Conservation in Ireland
GIS Operations :	RBSB13_SACs_ARB_DRB dataset, RBSB13_SACs_2012_HB dataset, RBSB13_SACs_DrainagePatterns_5k dataset and RBSB13_SAC_LIDAR_DTMs dataset clipped to SAC boundary. Expert opinion used as necessary to resolve any issues arising
Used For :	Potential 7110; digital elevation model; drainage patterns (maps 3 and 5)
Year :	2013
Title :	Raised Bog Monitoring and Assessment Survey 2013
GIS Operations :	RBMA13_ecotope_map dataset clipped to SAC boundary. Appropriate ecotopes selected and exported to new dataset. Expert opinion used as necessary to resolve any issues arising
Used For :	7110 ecotopes (map 4)
Year :	Digitised 2003
Title :	Raised Bog Restoration Project 1999
GIS Operations :	Ecotope dataset clipped to SAC boundary. Appropriate ecotopes selected and exported to new dataset. Expert opinion used as necessary to resolve any issues arising
Used For :	7110 ecotopes (map 4)
Year :	Revision 2010
Title :	National Survey of Native Woodlands 2003-2008. Version 1
GIS Operations :	QIs selected; clipped to SAC boundary. Expert opinion used as necessary to resolve any issues arising
Used For :	91A0, 91E0 (map 6)
Year :	2005
Title :	OSi Discovery series vector data
GIS Operations :	Creation of a 10m buffer on the terrestrial side of river banks data; creation of 20m buffer applied to canal centreline data. Creation of a 20m buffer applied to river and stream centreline data; These datasets combined with the derived OSI 1:5000 vector lake buffer data. Overlapping regions investigated and resolved; resulting dataset clipped to SAC boundary. Expert opinion used as necessary to resolve any issues arising
Used For :	1355 (no map)
Year :	2010
Title :	OSi 1:5000 IG vector dataset
GIS Operations :	Creation of 80m buffer on the aquatic side of lake data; creation of 10m buffer on the terrestrial side of lake data. These datasets combined with the derived OSi Discovery Series river and canal datasets. Overlapping regions investigated and resolved; resulting dataset clipped to SAC boundary. Expert opinion used as necessary to resolve any issues arising. Creation of 250m buffer on aquatic side of the lake boundary to highlight potential commuting points
Used For :	1355 (map 8)
Year :	2016
Title :	NPWS rare and threatened species database
GIS Operations :	Dataset created from spatial references in database records. Expert opinion used as necessary to resolve any issues arising
Used For :	1092 (map 7)

7110 Active raised bogs

To restore the favourable conservation condition of Active raised bogs in River Moy SAC, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Habitat area	Hectares	Restore area of active raised bog to 132.4ha, subject to natural processes	There are five raised bogs listed for River Moy SAC. The total area of Active Raised Bog (ARB) habitat for these five bogs was mapped at 45.3ha. Area of Degraded Raised Bog (DRB) on the High Bog (HB) has been modelled as 152.4ha. See map 3. However, it is estimated that only 82.1ha is potentially restorable to ARB by drain blocking. The total potential ARB on the HB is therefore estimated to be 127.4ha. Eco-hydrological assessments of the cutover estimates that an additional 5.0ha of bog forming habitats could be restored. The long term target for ARB is therefore 132.4ha. See raised bog supporting document for further details on this and following attributes
Habitat distribution	Occurrence	Restore the distribution and variability of active raised bog across the SAC. See map 4 for most recently mapped distribution	ARB occurs on most of the bogs in the River Moy SAC. DRB occurs on all five bogs in the River Moy SAC. There is also potential for ARB restoration on cutover areas surrounding the bogs (see area target above)
High bog area	Hectares	No decline in extent of high bog necessary to support the development and maintenance of active raised bog. See map 3	The area of high bog within the five raised bogs listed for River Moy SAC in 2012 (latest figure available) was 498.4ha (DAHG 2014)
Hydrological regime: water levels	Centimetres	Restore appropriate water levels throughout the site	For ARB, mean water level needs to be near or above the surface of the bog lawns for most of the year. Seasonal fluctuations should not exceed 20cm, and should only be 10cm below the surface, except for very short periods of time. Open water is often characteristic of soak systems
Hydrological regime: flow patterns	Flow direction; slope	Restore, where possible, appropriate high bog topography, flow directions and slopes. See map 5 for current situation	ARB depends on mean water levels being near or above the surface of bog lawns for most of the year. Long and gentle slopes are the most favourable to achieve these conditions. Changes to flow directions due to subsidence of bogs can radically change water regimes and cause drying out of high quality ARB areas and soak systems
Transitional areas between high bog and adjacent mineral soils (including cutover areas)	Hectares; distribution	Restore adequate transitional areas to support/protect active raised bog and the services it provides	ARB is threatened due to effects of past drainage and peat-cutting around the margins of the bogs within the River Moy SAC. Natural marginal habitats no longer exist. Eco-hydrological assessments have evaluated the potential for ARB restoration on cutover areas (see note for habitat area attribute above)
Vegetation quality: central ecotope, active flush, soaks, bog woodland	Hectares	Restore 66.2ha of central ecotope/active flush/soaks/bog woodland as appropriate	At least 50% of ARB habitat should be high quality (i.e. central ecotope, active flush, soaks, bog woodland). Target area of active raised bog for the site has been set at 132.4ha (see area target above)
Vegetation quality: microtopograph-ical features	Hectares	Restore adequate cover of high quality microtopographical features	High quality microtopography (hummocks, hollows and pools) is well developed in less disturbed parts of the bogs in River Moy SAC
Vegetation quality: bog moss (*Sphagnum*) species	Percentage cover	Restore adequate cover of bog moss (*Sphagnum*) species to ensure peat-forming capacity	*Sphagnum* cover varies naturally across Ireland with relatively high cover in the east to lower cover in the west. Hummock forming species such as *Sphagnum austinii* are particularly good peat formers. *Sphagnum* cover and distribution also varies naturally across a site

Typical ARB species: flora	Occurrence	Restore, where appropriate, typical active raised bog flora	Typical flora species include widespread species, as well as those with more restricted distributions but typical of the habitat's subtypes or geographical range
Typical ARB species: fauna	Occurrence	Restore, where appropriate, typical active raised bog fauna	Typical fauna species include widespread species, as well as those with more restricted distributions but typical of the habitat's subtypes or geographical range
Elements of local distinctiveness	Occurrence	Maintain features of local distinctiveness, subject to natural processes	An important feature of interest in relation to the raised bogs in the River Moy SAC is the fact that they occur at the north-western edge of the geographic range of the habitat in Ireland
Negative physical indicators	Percentage cover	Negative physical features absent or insignificant	Negative physical indicators include: bare peat, algae dominated pools and hollows, marginal cracks, tear patterns, subsidence features such as dry mineral mounds/ridges emerging or expanding and evidence of burning
Vegetation composition: native negative indicator species	Percentage cover	Native negative indicator species at insignificant levels	Disturbance indicators include species indicative of conditions drying out such as abundant bog asphodel (*Narthecium ossifragum*), deergrass (*Trichophorum germanicum*) and harestail cotton-grass (*Eriophorum vaginatum*) forming tussocks; abundant magellanic bog-moss (*Sphagnum magellanicum*) in pools previously dominated by *Sphagnum* species typical of very wet conditions (e.g. feathery bog-moss (*S. cuspidatum*)); and indicators of frequent burning events such as abundant *Cladonia floerkeana* and high cover of carnation sedge (*Carex panicea*) (particularly in true midlands raised bogs)
Vegetation composition: non-native invasive species	Percentage cover	Non-native invasive species at insignificant levels and not more than 1% cover	Most common non-native invasive species include lodgepole pine (*Pinus contorta*), rhododendron (*Rhododendron ponticum*), and pitcherplant (*Sarracenia purpurea*)
Air quality: nitrogen deposition	kg N/ha/year	Air quality surrounding bog close to natural reference conditions. The total N deposition should not exceed 5kg N/ha/yr	Change in air quality can result from fertiliser drift; adjacent quarry activities; or other atmospheric inputs. The critical load range for ombrotrophic bogs has been set as between 5 and 10kg N/ha/yr (Bobbink and Hettelingh, 2011). The latest N deposition figures for the area around the bogs in River Moy SAC suggests that the current level is approximately 8.5kg N/ha/yr (Henry and Aherne, 2014)
Water quality	Hydrochemical measures	Water quality on the high bog and in transitional areas close to natural reference conditions	Water chemistry within raised bogs is influenced by atmospheric inputs (rainwater). However, within soak systems, water chemistry is influenced by other inputs such as focused flow or interaction with underlying substrates. Water chemistry in areas surrounding the high bog varies due to influences of different water types (bog water, regional groundwater and run-off from surrounding mineral lands)

7120 Degraded raised bogs still capable of natural regeneration

The long-term aim for Degraded raised bogs still capable of natural regeneration is that its peat-forming capability is re-established; therefore, the conservation objective for this habitat is inherently linked to that of Active raised bogs (7110) and a separate conservation objective has not been set in River Moy SAC

Attribute	Measure	Target	Notes

7150	Depressions on peat substrates of the Rhynchosporion

Depressions on peat substrates of the Rhynchosporion is an integral part of good quality Active raised bogs (7110) and thus a separate conservation objective has not been set for the habitat in River Moy SAC

Attribute	Measure	Target	Notes

7230 Alkaline fens

To maintain the favourable conservation condition of Alkaline fens in River Moy SAC, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Habitat area	Hectares	Area stable or increasing, subject to natural processes	The full extent of of this habitat within the SAC is unknown. An extensive area is known to occur as part of a wetland complex on the Glore River, north-west of Ballyhaunis but there are likely to be other areas present in the SAC
Habitat distribution	Occurrence	No decline, subject to natural processes	Full distribution of the habitat in this SAC is currently unknown- see note above
Hydrological regime	Metres	Appropriate natural hydrological regimes necessary to support the natural structure and functioning of the habitat	Maintenance of groundwater, surface water flows and water table levels within natural ranges is essential for this wetland habitat
Peat formation	Flood duration	Active peat formation, where appropriate	In order for peat to form, water levels need to be slightly below or above the soil surface for c.90% of the time (Jim Ryan, pers. comm.)
Water quality: nutrients	Water chemistry measures	Appropriate water quality to support the natural structure and functioning of the habitat	Fens receive natural levels of nutrients (e.g. iron, magnesium and calcium) from water sources. However, they are generally poor in nitrogen and phosphorus with the latter tending to be tbe limiting nutrient
Vegetation structure: typical species	Percentage	Maintain vegetation cover of typical species including brown mosses and vascular plants	Mosses listed for fen in this SAC include *Campylium stellatum*, *Aneura pinguis* and *Scorpidium scorpioides* while vascular plants include long-stalked yellow sedge (*Carex lepidocarpa*), black bog rush (*Schoenus nigricans*), blunt-flowered rush (*Juncus subnodulosus*), purple moor-grass (*Molinia caerulea*), grass of Parnassus (*Parnassia palustris*), butterwort (*Pinguicula vulgaris*), marsh helleborine (*Epipactis palustris*) and meadow thistle (*Cirsium dissectum*) (internal NPWS files)
Vegetation composition: trees and shrubs	Percentage	Cover of scattered native trees and shrubs less than 10%	Scrub and trees will tend to invade if fen conditions become drier. Attribute and target based on upland habitat conservation assessment criteria (Perrin et al., 2014)
Physical structure: disturbed bare ground	Percentage	Cover of disturbed bare ground less than 10%. Where tufa is present, disturbed bare ground less than 1%	While grazing may be appropriate in this habitat, excessive areas of disturbed bare ground may develop due to unsuitable grazing regimes. Attribute and target based on upland habitat conservation assessment criteria (Perrin et al., 2014)
Physical structure: drainage	Percentage	Areas showing signs of drainage as a result of drainage ditches or heavy trampling less than 10%	Attribute and target based on upland habitat conservation assessment criteria (Perrin et al., 2014)

91A0 Old sessile oak woods with Ilex and Blechnum in the British Isles

To maintain the favourable conservation condition of Old sessile oak woods with *Ilex* and *Blechnum* in the British Isles in River Moy SAC, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Habitat area	Hectares	Area stable or increasing, subject to natural processes	Old sessile oakwoods are likely to occur as mosaics with other woodland types and the total extent within the SAC is unknown. Two sites (1763, 1800) in the SAC were surveyed as part of the the National Survey of Native Woodlands (NSNW) (Perrin et al., 2008). Site 1763 (Pontoon) is an extensive area of woodland and 106.3ha was mapped as this Annex I habitat type (or mosaics containing it). See map 6. NB further areas are likely to be present within the SAC
Habitat distribution	Occurrence	No decline. Woodlands surveyed as part of the NSNW are shown on map 6	The main location of this woodland type in the SAC is Pontoon Woods. See note on area above
Woodland size	Hectares	Area stable or increasing. Where topographically possible, "large"; woods at least 25ha in size and "small" woods at least 3ha in size	The sizes of at least some of the existing woodlands need to be increased in order to reduce habitat fragmentation and benefit those species requiring "deep" woodland conditions (Peterken, 2002). Topographical and land ownership constraints may restrict expansion
Woodland structure: cover and height	Percentage and metres	Diverse structure with a relatively closed canopy containing mature trees; subcanopy layer with semi-mature trees and shrubs; and well-developed herb layer	Described in Perrin et al (2008)
Woodland structure: community diversity and extent	Hectares	Maintain diversity and extent of community types	Described in Perrin et al. (2008)
Woodland structure: natural regeneration	Seedling: sapling: pole ratio	Seedlings, saplings and pole age-classes occur in adequate proportions to ensure survival of woodland canopy	Oak (*Quercus* spp.) regenerates poorly. In suitable sites ash (*Fraxinus excelsior*) can regenerate in large numbers although few seedlings reach pole size
Woodland structure: dead wood	m^3 per hectare; number per hectare	At least $30m^3$/ha of fallen timber greater than 10cm diameter; 30 snags/ha; both categories should include stems greater than 40cm diameter	Dead wood is a valuable resource and an integral part of a healthy, functioning woodland ecosystem
Woodland structure: veteran trees	Number per hectare	No decline	Mature and veteran trees are important habitats for bryophytes, lichens, saproxylic organisms and some bird species. Their retention is important to ensure continuity of habitats/niches and propagule sources
Woodland structure: indicators of local disctinctiveness	Occurrence	No decline	Includes ancient or long-established woodlands, archaeological and geological features as well as red-data and other rare or localised species. Perrin and Daly (2010) list Pontoon Wood as possible ancient woodland
Vegetation composition: native tree cover	Percentage	No decline. Native tree cover not less than 95%	Species reported in Perrin et al. (2008)

Vegetation composition: typical species	Occurrence	A variety of typical native species present, depending on woodland type, including oak (*Quercus petraea*) and birch (*Betula pubescens*)	Species reported in Perrin et al. (2008)
Vegetation composition: negative indicator species	Occurrence	Negative indicator species, particularly non-native invasive species, absent or under control	The following are the most common invasive species in this woodland type: beech (*Fagus sylvatica*), sycamore (*Acer psudoplatanus*), rhododendron (*Rhododendron ponticum*) and cherry laurel (*Prunus laurocerasus*)

91E0 Alluvial forests with Alnus glutinosa and Fraxinus excelsior (Alno-Padion, Alnion incanae, Salicion albae)

To maintain the favourable conservation condition of Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (Alno-Padion, Alnion incanae, Salicion albae) in River Moy SAC, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Habitat area	Hectares	Area stable or increasing, subject to natural processes	Total extent of this habitat within the SAC is unknown and it may occur in mosaics with other woodland types. Two sites (1763, 1800) within the SAC were surveyed as part of the the National Survey of Native Woodlands (NSNW) (Perrin et al., 2008). Map 6 shows surveyed woodlands including areas classified as 91E0 (2.76ha). NB areas mapped as other wet woodland types may also correspond with this Annex I woodland type. There are also likely to be additional areas of this Annex I woodland type within the SAC
Habitat distribution	Occurrence	No decline. Woodlands surveyed as part of the NSNW are shown on map 6	The area of this habitat identified by the NSNW occurs at Prospect (site 1800) on the western shore of Lough Conn. See note on area above
Woodland size	Hectares	Area stable or increasing. Where topographically possible, "large" woods at least 25ha in size and "small" woods at least 3ha in size	The sizes of at least some of the existing woodlands need to be increased in order to reduce habitat fragmentation and benefit those species requiring 'deep' woodland conditions (Peterken, 2002). Topographical and land-ownership constraints may restrict expansion
Woodland structure: cover and height	Percentage and metres	Diverse structure with a relatively closed canopy containing mature trees; subcanopy layer with semi-mature trees and shrubs; and well-developed herb layer	Described in Perrin et al. (2008)
Woodland structure: community diversity and extent	Hectares	Maintain diversity and extent of community types	Described in Perrin et al. (2008)
Woodland structure: natural regeneration	Seedling: sapling: pole ratio	Seedlings, saplings and pole age-classes occur in adequate proportions to ensure survival of woodland canopy	Alder (*Alnus glutinosa*) and oak (*Quercus* spp.) regenerate poorly. Ash (*Fraxinus excelsior*) often regenerates in large numbers although few seedlings reach pole size
Hydrological regime: Flooding depth/height of water table	Metres	Appropriate hydrological regime necessary for maintenance of alluvial vegetation	Periodic flooding is essential to maintain alluvial woodlands along river floodplains and lakeshores
Woodland structure: dead wood	m^3 per hectare; number per hectare	At least $30m^3$/ha of fallen timber greater than 10cm diameter; 30 snags/ha; both categories should include stems greater than 40cm diameter (greater than 20cm diameter in the case of alder)	Dead wood is a valuable resource and an integral part of a healthy, functioning woodland ecosystem
Woodland structure: veteran trees	Number per hectare	No decline	Mature and veteran trees are important habitats for bryophytes, lichens, saproxylic organisms and some bird species. Their retention is important to ensure continuity of habitats/niches and propagule sources
Woodland structure: indicators of local disctinctiveness	Occurrence	No decline	Includes ancient or long-established woodlands, archaeological and geological features as well as red-data and other rare or localised species

Vegetation composition: native tree cover	Percentage	No decline. Native tree cover not less than 95%	Species reported in Perrin et al. (2008)
Vegetation composition: typical species	Occurrence	A variety of typical native species present, depending on woodland type, including including alder (*Alnus glutinosa*), willows (*Salix* spp.), oak (*Quercus robur*) and ash (*Fraxinus excelsior*)	Species reported in Perrin et al. (2008)
Vegetation composition: negative indicator species	Occurrence	Negative indicator species, particularly non-native invasive species, absent or under control	The following are the most common invasive species in this woodland type: sycamore (*Acer pseudoplatanus*) and Himalayan balsam (*Impatiens glandulifera*). The NSNW notes rhododendron (*Rhododendron ponticum*) clearance in site 1800

1092 White-clawed Crayfish *Austropotamobius pallipes*

To maintain the favourable conservation condition of White-clawed Crayfish in River Moy SAC, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Distribution	Occurrence	No reduction from baseline. See map 7	The general distribution of white-clawed crayfish in the SAC is that it is widespread in the upper tributaries of the River Moy and the rivers which feed Loughs Conn and Cullin. It is absent from the main River Moy. The named tributaries that it is recorded from are the following: Upstream of Lough Conn: River Deel and its tributaries of the Toreen River, Rathnamagh River and Rappa Stream; Fiddaunglass; Addergoole River. Upstream of Lough Cullin: Tobergal River; Clydagh; tributaries of the Toormore and Manulla Rivers. Moy tributaries: Gweestion River; tributaries of the Pollagh, Glore, Yellow and Geestaun Rivers; Killeen River; Spaddagh River; Sonnagh River; Owenaher River; Owengarve River
Population structure: recruitment	Occurrence of juveniles and females with eggs	Juveniles and/or females with eggs in all occupied tributaries	See Reynolds et al. (2010) for further details
Negative indicator species	Occurrence	No alien crayfish species	Alien crayfish species are identified as a major direct threat to this species and as a disease vector. See Reynolds (1998) for further details. Ireland is currently free of non-native invasive crayfish species
Disease	Occurrence	No instances of disease	Crayfish plague is identified as major threat and has occurred in Ireland even in the absence of alien vectors. See Reynolds (1998) for further details. Disease can in some circumstances be introduced through contaminated equipment and water in the absence of vector species
Water quality	EPA Q value	At least Q3-4 at all sites sampled by EPA	Target taken from Demers and Reynolds (2002). Q values based on triennial water quality surveys carried out by the EPA
Habitat quality: heterogeneity	Occurrence of positive habitat features	No decline in heterogeneity or habitat quality	Crayfish need high habitat heterogeneity. Larger crayfish must have stones to hide under, or an earthen bank in which to burrow. Hatchlings shelter in vegetation, gravel and among fine tree-roots. Smaller crayfish are typically found among weed and debris in shallow water. Larger juveniles in particular may also be found among cobbles and detritus such as leaf litter. These conditions must be available on the whole length of occupied habitat

1095 Sea Lamprey *Petromyzon marinus*

To maintain the favourable conservation condition of Sea Lamprey in River Moy SAC, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Distribution: extent of anadromy	Percentage of river accessible	Greater than 75% of main stem length of rivers accessible from estuary	This SAC only covers the freshwater portion of the River Moy. The adjacent Killala Bay/Moy Estuary SAC (site code: 000485) encompasses the estuarine elements of sea lamprey habitat. Artificial barriers can block or cause difficulties to lampreys' upstream migration, thereby limiting species to lower stretches and restricting access to spawning areas (Rooney et al. 2015), however, there are no artificial barriers in the Moy catchment limiting lamprey access
Population structure of juveniles	Number of age/size groups	At least three age/size groups present	Attribute and target based on Harvey and Cowx (2003) and O'Connor (2007)
Juvenile density in fine sediment	Juveniles/m²	Mean catchment juvenile density at least 1/m²	Juveniles burrow in areas of fine sediment in still water. Attribute and target based on Harvey and Cowx (2003)
Extent and distribution of spawning habitat	m² and occurrence	No decline in extent and distribution of spawning beds	Attribute and target based on spawning bed mapping by Inland Fisheries Ireland (IFI). Lampreys spawn in clean gravels
Availability of juvenile habitat	Number of positive sites in 3rd order channels (and greater), downstream of spawning areas	More than 50% of sample sites positive	Silting habitat is essential for larval lamprey and they can be severely impacted by sediment removal. Recovery can be rapid and newly-created habitat can be rapidly colonised (King et al., 2015). However, it is vital that such sedimenting habitats are retained. Occupancy in excess of 50% of sites would be 'reasonable' for the Irish catchments examined to date. (King and Linnane, 2004; King et al., unpublished data)

1096 Brook Lamprey *Lampetra planeri*

To maintain the favourable conservation condition of Brook Lamprey in River Moy SAC, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Distribution	Percentage of river accessible	Access to all watercourses down to first order streams	Artificial barriers can block lampreys' migration both up- and downstream, thereby possibly limiting species to specific stretches, restricting access to spawning areas and creating genetically isolated populations (Espanhol et al., 2007). However, there are no artificial barriers in the Moy catchment limiting lamprey access
Population structure of juveniles	Number of age/size groups	At least three age/size groups of brook/river lamprey present	Attribute and target based on data from Harvey and Cowx (2003). It is impossible to distinguish between brook and river lamprey juveniles in the field (Gardiner, 2003), hence they are considered together in this target
Juvenile density in fine sediment	Juveniles/m²	Mean catchment juvenile density of brook/river lamprey at least 2/m²	Juveniles burrow in areas of fine sediment in still water. Attribute and target based on data from Harvey and Cowx (2003) who state 10/m² in optimal conditions and more than 2/m² on a catchment basis
Extent and distribution of spawning habitat	m² and occurrence	No decline in extent and distribution of spawning beds	Attribute and target based on spawning bed mapping by Inland Fisheries Ireland (IFI). Lampreys spawn in clean gravels
Availability of juvenile habitat	Number of positive sites in 2nd order channels (and greater), downstream of spawning areas	More than 50% of sample sites positive	Silting habitat is essential for larval lamprey and they can be severely impacted by sediment removal. Recovery can be rapid and newly-created habitat can be rapidly colonised (King et al., 2015). However, it is vital that such sedimenting habitats are retained. Occupancy in excess of 50% of sites would be 'reasonable' for the Irish catchments examined to date. (King and Linnane, 2004; King et al., unpublished data)

1106 Salmon *Salmo salar*

To maintain the favourable conservation condition of Salmon in River Moy SAC, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Distribution: extent of anadromy	Percentage of river accessible	100% of river channels down to second order accessible from estuary	Artificial barriers block salmons' upstream migration, thereby limiting species to lower stretches and restricting access to spawning areas. There are no artificial barriers on the Moy catchment limiting salmon access
Adult spawning fish	Number	Conservation Limit (CL) for each system consistently exceeded	A conservation limit is defined by the North Atlantic Salmon Conservation Organisation (NASCO) as "the spawning stock level that produces long-term average maximum sustainable yield as derived from the adult to adult stock and recruitment relationship". The target is based on the Standing Scientific Committee of the National Salmon Commission's annual model output of CL attainment levels. See SSC (2016). Stock estimates are either derived from direct counts of adults (rod catch, fish counter) or indirectly by fry abundance counts. For the 2016 SSC advice, the Moy is currently exceeding its CL by 19,012 salmon
Salmon fry abundance	Number of fry/5 minutes electrofishing	Maintain or exceed 0+ fry mean catchment-wide abundance threshold value. Currently set at 17 salmon fry/5 minutes sampling	Target is threshold value for rivers currently exceeding their conservation limit (CL)
Out-migrating smolt abundance	Number	No significant decline	Smolt abundance can be negatively affected by a number of impacts such as estuarine pollution, predation and sea lice (*Lepeophtheirus salmonis*)
Number and distribution of redds	Number and occurrence	No decline in number and distribution of spawning redds due to anthropogenic causes	Salmon spawn in clean gravels. There are no artificial barriers preventing salmon from accessing suitable spawning habitat in this SAC
Water quality	EPA Q value	At least Q4 at all sites sampled by EPA	Q values based on triennial water quality surveys carried out by the Environmental Protection Agency (EPA)

1355 Otter *Lutra lutra*

To maintain the favourable conservation condition of Otter in River Moy SAC, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Distribution	Percentage positive survey sites	No significant decline	Measure based on standard otter survey technique. FCS target, based on 1980/81 survey findings, is 88% in SACs. Current range is estimated at 93.6% (Reid et al., 2013)
Extent of terrestrial habitat	Hectares	No significant decline. Area mapped and calculated as 1068.8ha	No field survey. Areas mapped to include 10m terrestrial buffer along lake shorelines and along river banks identified as critical for otters (NPWS, 2007)
Extent of freshwater (river) habitat	Kilometres	No significant decline. Length mapped and calculated as 479.4km	No field survey. River length calculated on the basis that otters will utilise freshwater habitats from estuary to headwaters (Chapman and Chapman, 1982)
Extent of freshwater (lake) habitat	Hectares	No significant decline. Area mapped and calculated as 1248.2ha	No field survey. Area mapped based on evidence that otters tend to forage within 80m of the shoreline (NPWS, 2007)
Couching sites and holts	Number	No significant decline	Otters need lying up areas throughout their territory where they are secure from disturbance (Kruuk, 2006; Kruuk and Moorhouse, 1991)
Fish biomass available	Kilograms	No significant decline	Broad diet that varies locally and seasonally, but dominated by fish, in particular salmonids, eels and sticklebacks in freshwater (Bailey and Rochford, 2006; Reid et al., 2013)
Barriers to connectivity	Number	No significant increase. For guidance, see map 8	Otters will regularly commute across stretches of open water up to 500m e.g. between the mainland and an island; between two islands; across an estuary (De Jongh and O'Neill, 2010). It is important that such commuting routes are not obstructed

MAP 1:
RIVER MOY SAC
CONSERVATION OBJECTIVES
SAC DESIGNATION

Map to be read in conjunction with the NPWS Conservation Objectives Document.

SITE CODE:
SAC 002298; version 3.01. CO. MAYO, CO. SLIGO & CO. ROSCOMMON

0 2 4 6 8 10 km

The mapped boundaries are of an indicative and general nature only. Boundaries of designated areas are subject to revision.
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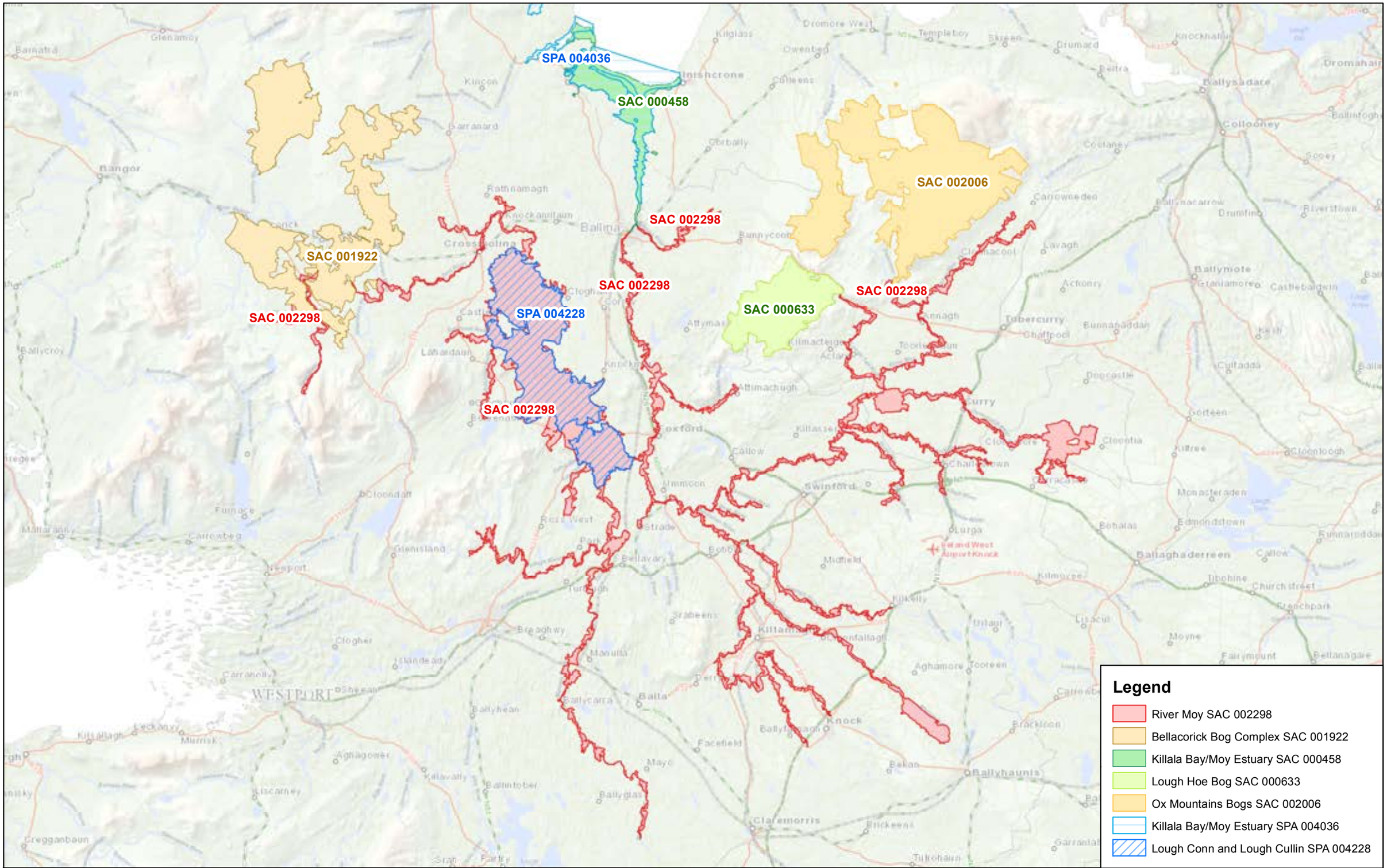
Níl sna teorainneacha ar na léarscáileanna ach nod garshuiomhach ginearálta. Féadfar athbhreithnithe a déanamh ar theorainneacha na gceantar comharthaithe. Suirbhéarachta Ordonáis na hÉireann Ceadúnas

Legend
River Moy SAC 002298

N

Map Version 1
Date: July 2016



An Roinn Ealaíon, Oidhreachta, Gnóthaí Réigiúnacha, Tuaithe agus Gaeltachta
Department of Arts, Heritage, Regional, Rural and Gaeltacht Affairs

MAP 2:
RIVER MOY SAC
CONSERVATION OBJECTIVES
ADJACENT / ADJOINING & OVERLAPPING DESIGNATIONS

Map to be read in conjunction with the NPWS Conservation Objectives Document.

SITE CODE:
SAC 002298; version 3.01. CO. MAYO, CO. SLIGO & CO. ROSCOMMON

0 2.5 5 7.5 10 12.5 km

N

Map Version 1
Date: July 2016

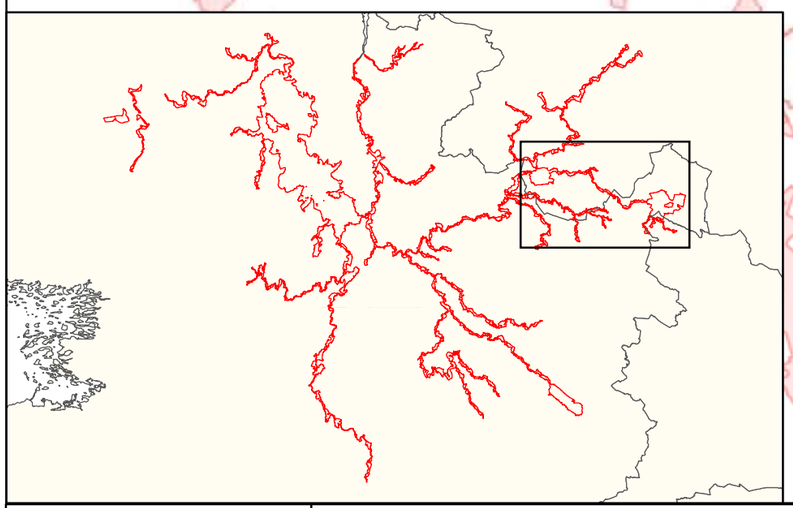
Cloongoonagh Bog

Gowlaun Bog

Tawnaghbeg Bog

Derrynabrock Bog

Kilgarriff Bog



Legend

- River Moy SAC 002298
- High Bog Boundary
- Potential 7110 Active Raised Bogs

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Department of Arts, Heritage, Regional, Rural and Gaeltacht Affairs

MAP 3:
RIVER MOY SAC
CONSERVATION OBJECTIVES
EXTENT OF POTENTIAL
ACTIVE RAISED BOGS

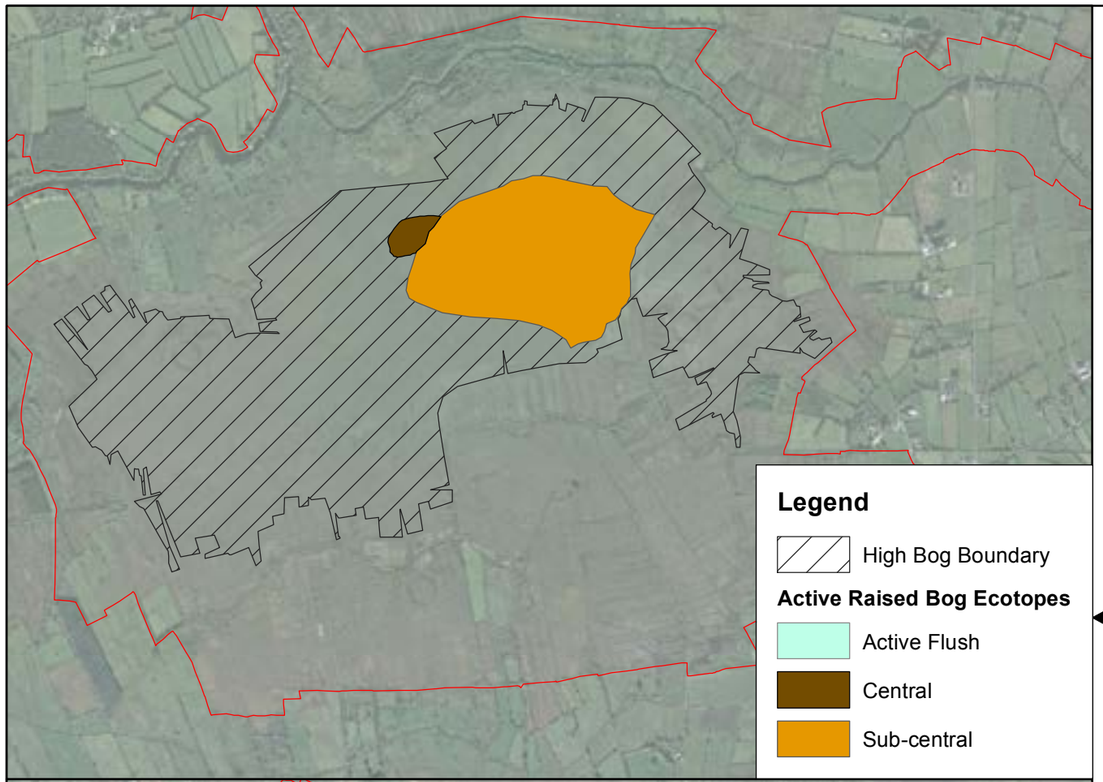
Map to be read in conjunction with the NPWS Conservation Objectives Document.

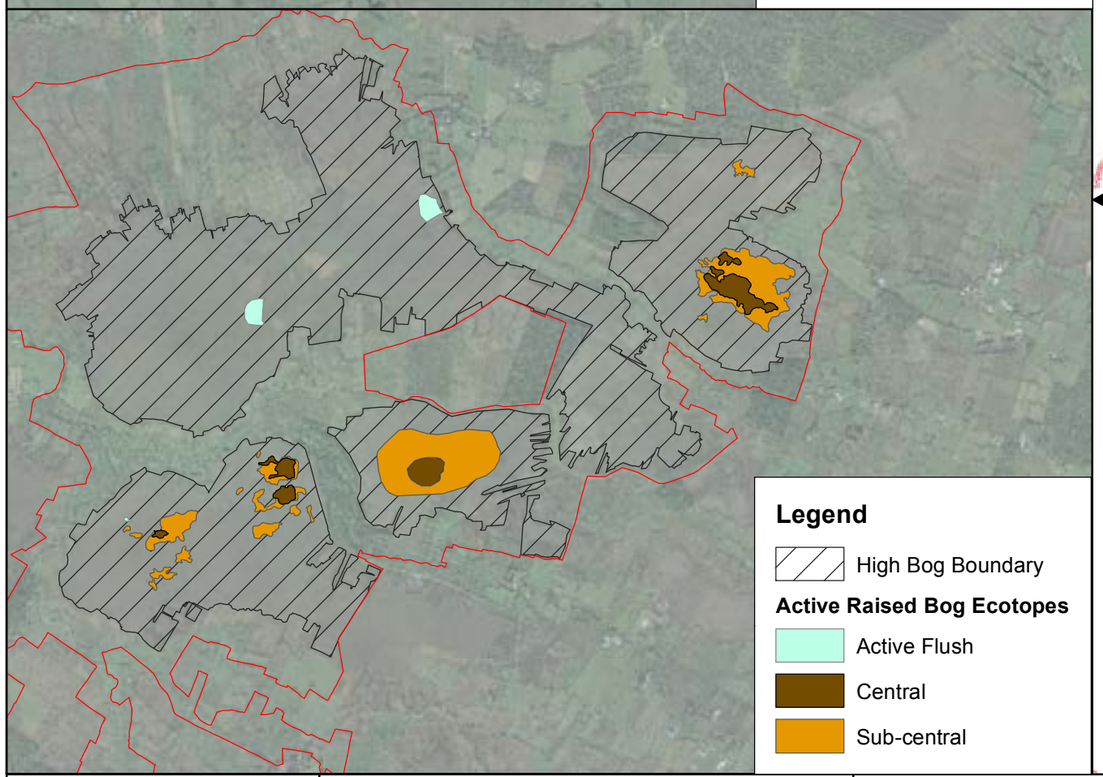
SITE CODE:
SAC 002298; version 3.01. CO. MAYO, CO. SLIGO & CO. ROSCOMMON

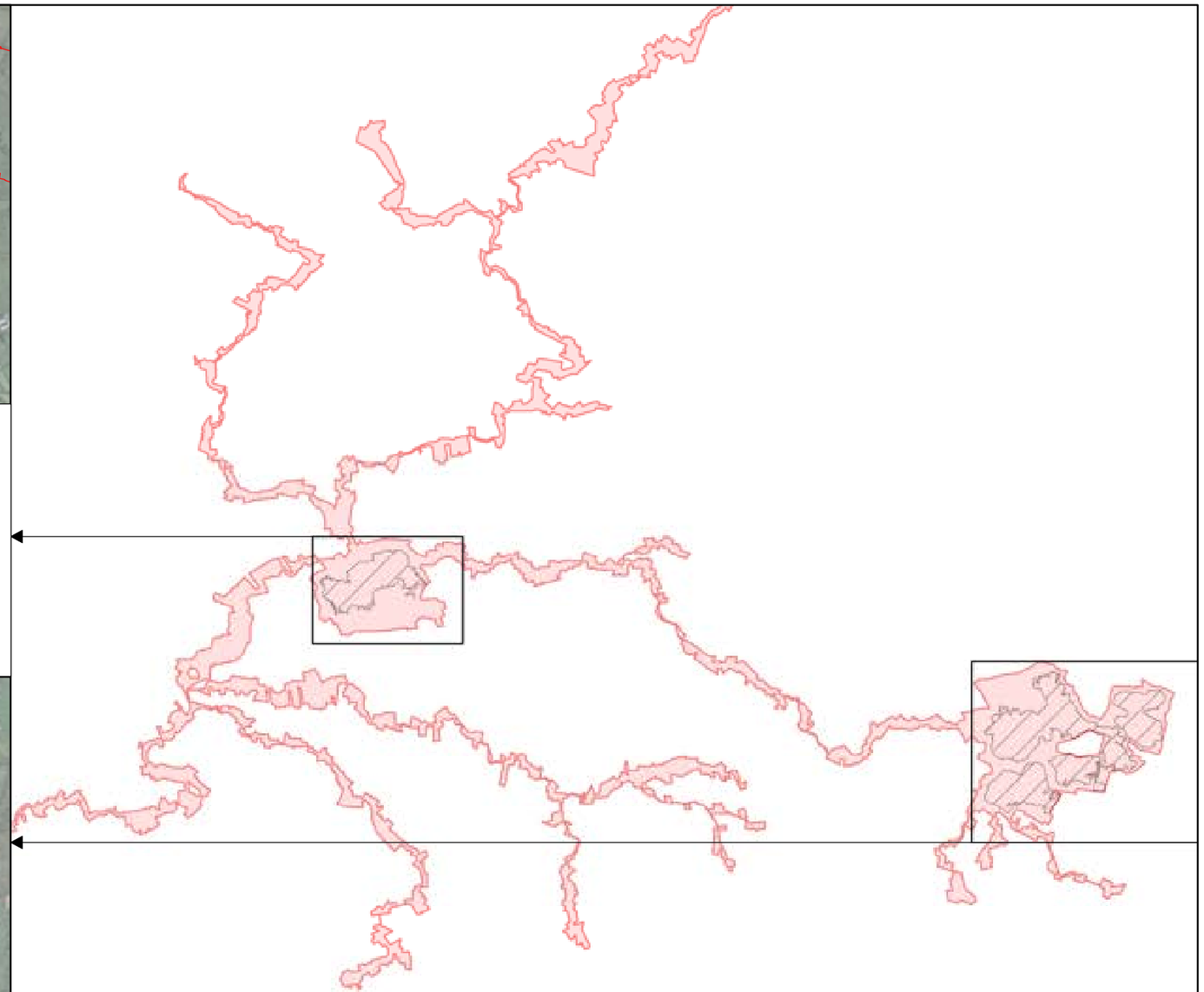
0 0.45 0.9 1.35 1.8 2.25 km

N

Map Version 1
Date: July 2016







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Department of Arts, Heritage, Regional, Rural and Gaeltacht Affairs

MAP 4:
RIVER MOY SAC
CONSERVATION OBJECTIVES
ACTIVE RAISED BOG
ECOTOPES

Map to be read in conjunction with the NPWS Conservation Objectives Document.

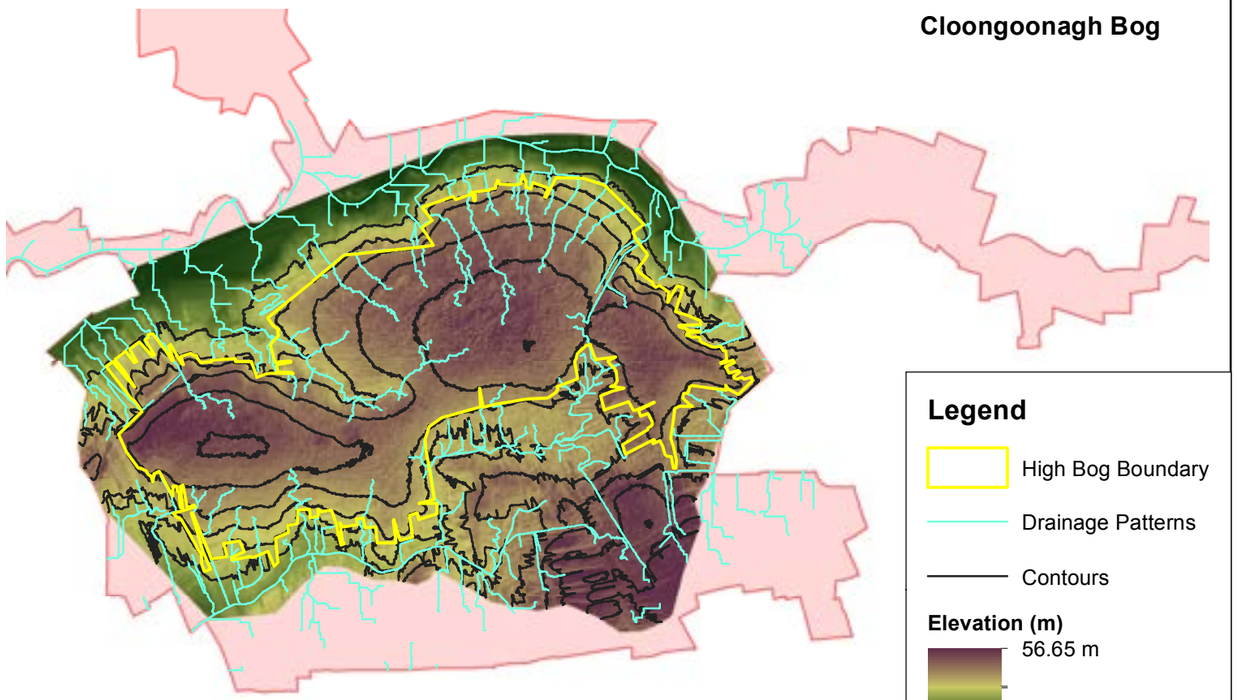
SITE CODE:
SAC 002298; version 3.01. CO. MAYO, CO. SLIGO & CO. ROSCOMMON

0 1 2 3 4 5 km

N

Map Version 1
Date: July 2016

Cloongoonagh Bog



Legend

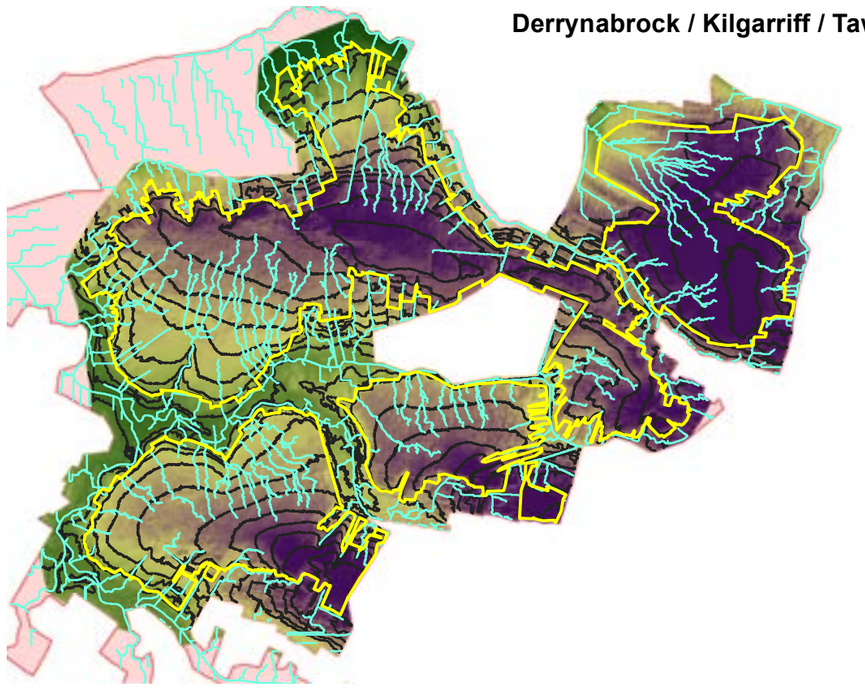
- High Bog Boundary
- Drainage Patterns
- Contours

Elevation (m)

56.65 m

39.86 m

Derrynabrock / Kilgarriff / Tawnabeg / Gowlaun Bogs



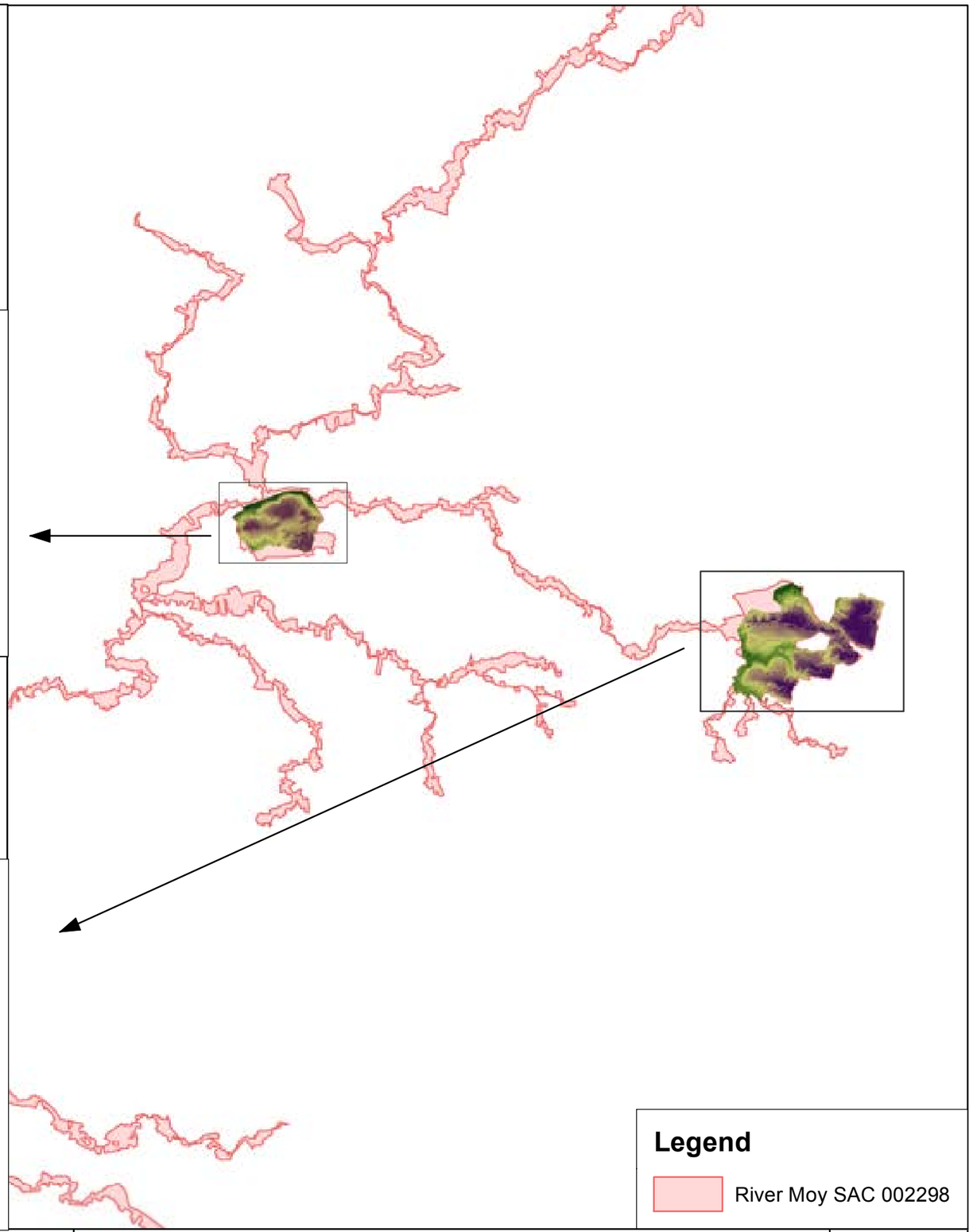
Legend

- High Bog Boundary
- Drainage Patterns
- Contours

Elevation (m)

91.94 m

71.07 m



Legend

- River Moy SAC 002298

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Department of Arts, Heritage, Regional, Rural and Gaeltacht Affairs

MAP 5:
RIVER MOY SAC
CONSERVATION OBJECTIVES
ACTIVE RAISED BOG
DIGITAL ELEVATION MODEL
& DRAINAGE PATTERN

Map to be read in conjunction with the NPWS Conservation Objectives Document.

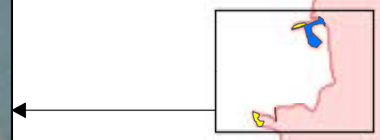
SITE CODE:
SAC 002298; version 3.01. CO. MAYO, CO. SLIGO & CO. ROSCOMMON

0 1.5 3 4.5 6 7.5 km

N

Map Version 1
Date: July 2016

NSNW Site Code: 1800



Legend

River Moy SAC 002298

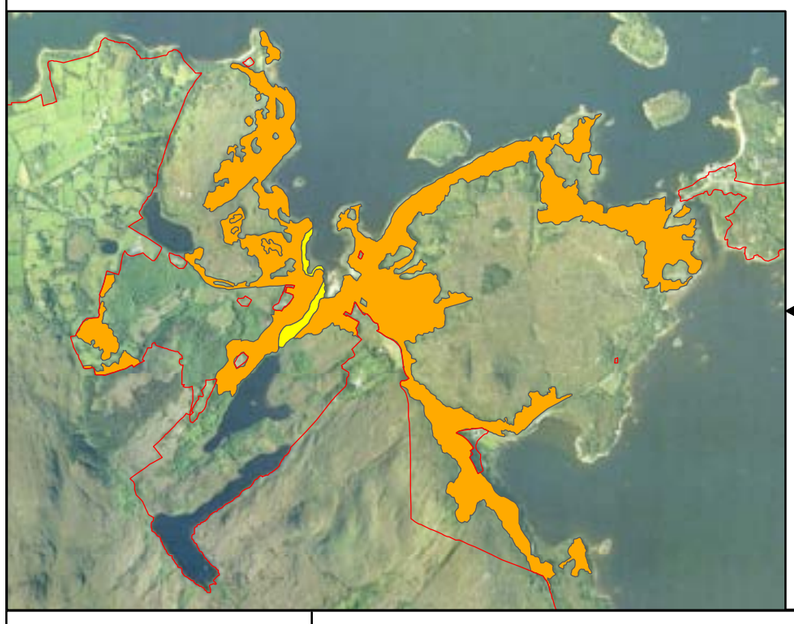
Qualifying Interests

91A0 Old sessile oak woods with Ilex and Blechnum in the British Isles

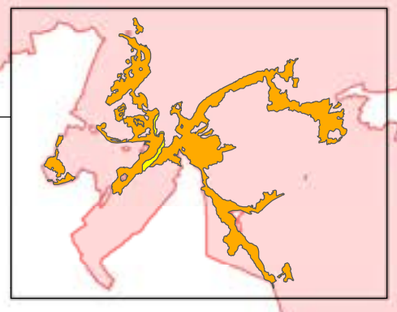
91E0 Alluvial forests with Alnus glutinosa and Fraxinus excelsior (Alno-Pandion, Alnion incanae, Salicion albae)

Non Qualifying Interests

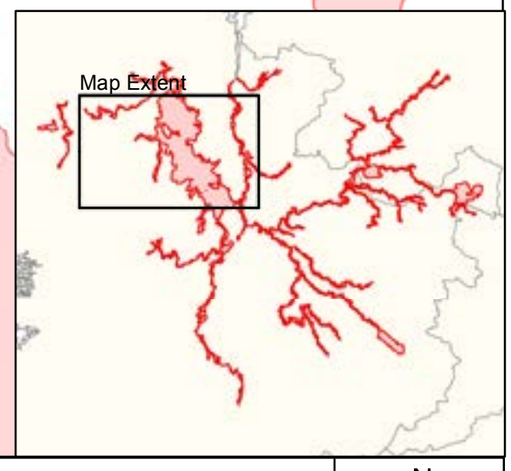
WN6, Wet willow-alder-ash woodland



NSNW Site Code: 1763



Map Extent



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Department of Arts, Heritage, Regional, Rural and Gaeltacht Affairs

MAP 6:
RIVER MOY SAC
CONSERVATION OBJECTIVES
WOODLAND HABITATS

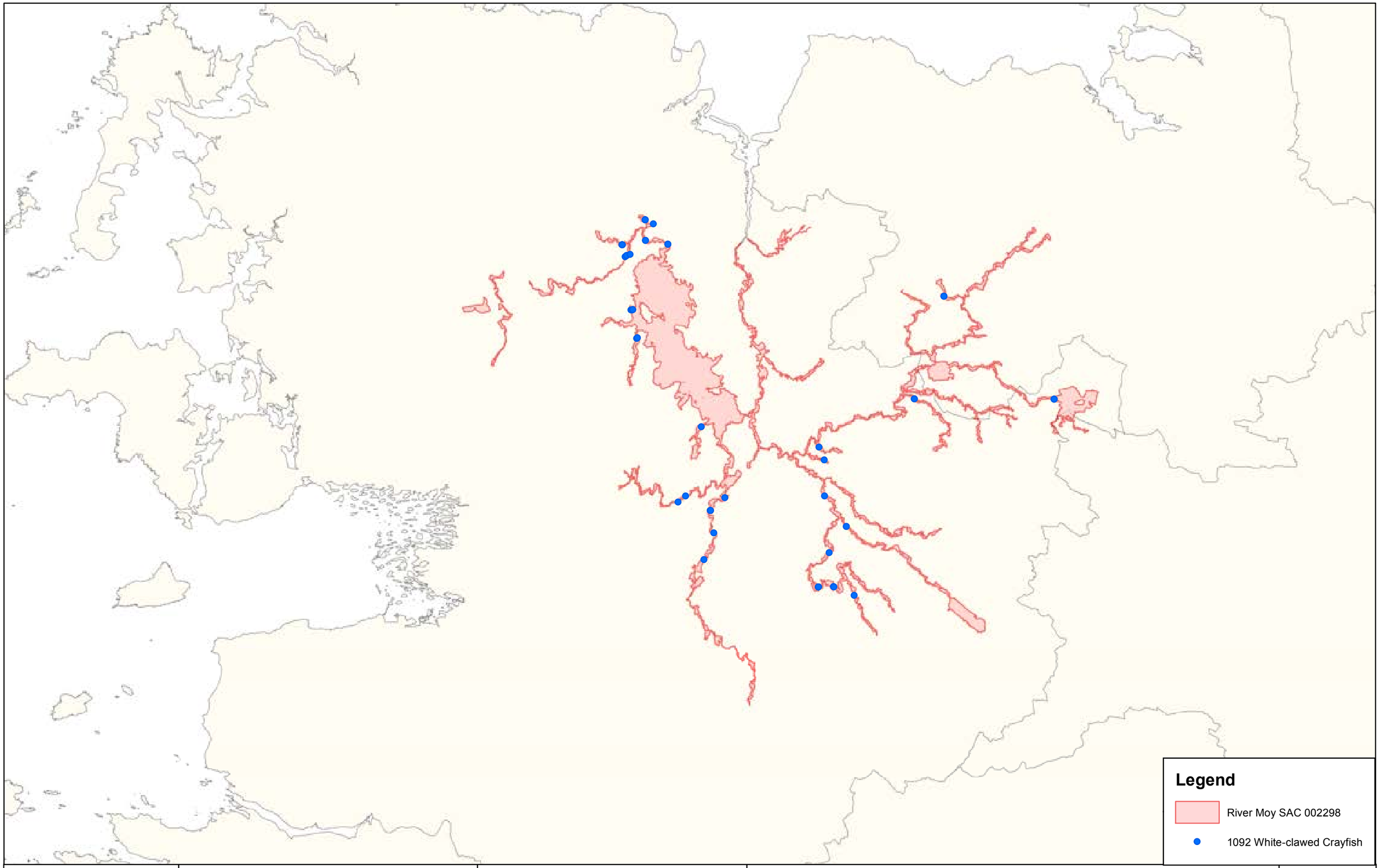
Map to be read in conjunction with the NPWS Conservation Objectives Document.

SITE CODE:
SAC 002298; version 3.01. CO. MAYO, CO. SLIGO & CO. ROSCOMMON

0 1 2 3 4 km

N

Map Version 1
Date:July 2016



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MAP 7:
RIVER MOY SAC
CONSERVATION OBJECTIVES
WHITE-CLAWED CRAYFISH

Map to be read in conjunction with the NPWS Conservation Objectives Document.

SITE CODE:
SAC 002298; version 3.01. CO. MAYO, CO. SLIGO & CO. ROSCOMMON

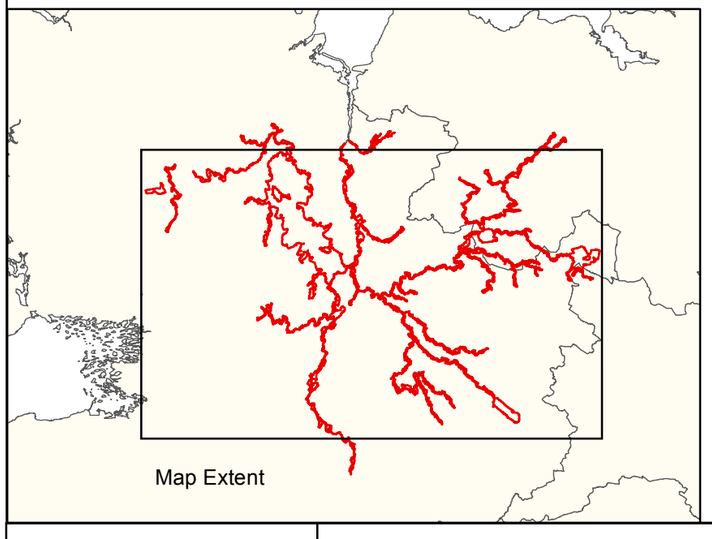
0 5.5 11 16.5 22 km

N

Map Version 1
Date: July 2016

Legend

- River Moy SAC 002298
- 1355 Otter - *Lutra lutra* commuting 250m buffer



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Department of Arts, Heritage, Regional, Rural and Gaeltacht Affairs

MAP 8:
RIVER MOY SAC
CONSERVATION OBJECTIVES
OTTER COMMUTING

Map to be read in conjunction with the NPWS Conservation Objectives Document.

SITE CODE:
SAC 002298; version 3.01. CO. MAYO, CO. SLIGO & CO. ROSCOMMON

0 1.5 3 4.5 6 7.5 km

N

Map Version 1
Date: July 2016

ISSN 2009-4086

National Parks and Wildlife Service

Conservation Objectives Series

Killala Bay/Moy Estuary SPA 004036

An Roinn
Ealaíon, Oidhreachta agus Gaeltachta
Department of
Arts, Heritage and the Gaeltacht

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Department of Arts, Heritage and the Gaeltacht,

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E-mail: nature.conservation@ahg.gov.ie

Citation:

NPWS (2013) Conservation Objectives: Killala Bay/Moy Estuary SPA 004036. Version 1. National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht.

Series Editor: Rebecca Jeffrey
ISSN 2009-4086

Introduction

The overall aim of the Habitats Directive is to maintain or restore the favourable conservation status of habitats and species of community interest. These habitats and species are listed in the Habitats and Birds Directives and Special Areas of Conservation and Special Protection Areas are designated to afford protection to the most vulnerable of them. These two designations are collectively known as the Natura 2000 network.

European and national legislation places a collective obligation on Ireland and its citizens to maintain habitats and species in the Natura 2000 network at favourable conservation condition. The Government and its agencies are responsible for the implementation and enforcement of regulations that will ensure the ecological integrity of these sites.

A site-specific conservation objective aims to define favourable conservation condition for a particular habitat or species at that site.

The maintenance of habitats and species within Natura 2000 sites at favourable conservation condition will contribute to the overall maintenance of favourable conservation status of those habitats and species at a national level.

Favourable conservation status of a habitat is achieved when:

- its natural range, and area it covers within that range, are stable or increasing, and
- 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.

The 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, and
- 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.

Notes/Guidelines:

1. The targets given in these conservation objectives are based on best available information at the time of writing. As more information becomes available, targets for attributes may change. These will be updated periodically, as necessary.
2. An appropriate assessment based on these conservation objectives will remain valid even if the targets are subsequently updated, providing they were the most recent objectives available when the assessment was carried out. It is essential that the date and version are included when objectives are cited.
3. Assessments cannot consider an attribute in isolation from the others listed for that habitat or species, or for other habitats and species listed for that site. A plan or project with an apparently small impact on one attribute may have a significant impact on another.
4. Please note that the maps included in this document do not necessarily show the entire extent of the habitats and species for which the site is listed. This should be borne in mind when appropriate assessments are being carried out.
5. When using these objectives, it is essential that the relevant backing/supporting documents are consulted, particularly where instructed in the targets or notes for a particular attribute.

Qualifying Interests

**** indicates a priority habitat under the Habitats Directive***

004036	Killala Bay/Moy Estuary SPA
A137	Ringed Plover *Charadrius hiaticula*
A140	Golden Plover *Pluvialis apricaria*
A141	Grey Plover *Pluvialis squatarola*
A144	Sanderling *Calidris alba*
A149	Dunlin *Calidris alpina alpina*
A157	Bar-tailed Godwit *Limosa lapponica*
A160	Curlew *Numenius arquata*
A162	Redshank *Tringa totanus*
A999	Wetlands

Please note that this SPA overlaps with Killala Bay/Moy Estuary SAC (000458) and Lackan Saltmarsh and Kilcummin Head SAC (000516). See map 2. The conservation objectives for this site should be used in conjunction with those for the overlapping sites as appropriate.

Supporting documents, relevant reports & publications

Supporting documents, NPWS reports and publications are available for download from: www.npws.ie/Publications

NPWS Documents

Year :	2013
Title :	Killala Bay/Moy Estuary SPA (site code 4036) Conservation objectives supporting document V1
Author :	NPWS
Series :	Conservation objectives supporting document

A137 Ringed Plover *Charadrius hiaticula*

To maintain the favourable conservation condition of Ringed Plover in Killala Bay/Moy Estuary SPA, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Population trend	Percentage change	Long term population trend stable or increasing	Population trends are presented in part four of the conservation objectives supporting document
Distribution	Number and range of areas used by waterbirds	No significant decrease in the range, timing or intensity of use of areas by ringed plover, other than that occurring from natural patterns of variation	Waterbird distribution from the 2010/2011 waterbird survey programme is discussed in part five of conservation objectives supporting document

A140 Golden Plover *Pluvialis apricaria*

To maintain the favourable conservation condition of Golden Plover in Killala Bay/Moy Estuary SPA, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Population trend	Percentage change	Long term population trend stable or increasing	Population trends are presented in part four of the conservation objectives supporting document
Distribution	Number, range, timing and intensity of use of areas	No significant decrease in the range, timing or intensity of use of areas by golden plover, other than that occurring from natural patterns of variation	Waterbird distribution from the 2010/2011 waterbird survey programme is discussed in part five of the conservation objectives supporting document

A141 Grey Plover *Pluvialis squatarola*

To maintain the favourable conservation condition of Grey Plover in Killala Bay/Moy Estuary SPA, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Population trend	Percentage change	Long term population trend stable or increasing	Population trends are presented in part four of the conservation objectives supporting document
Distribution	Number, range, timing and intensity of use of areas	No significant decrease in the range, timing or intensity of use of areas by grey plover, other than that occurring from natural patterns of variation	Waterbird distribution from the 2010/2011 waterbird survey programme is discussed in part five of the conservation objectives supporting document

A144 Sanderling *Calidris alba*

To maintain the favourable conservation condition of Sanderling in Killala Bay/Moy Estuary SPA, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Population trend	Percentage change	Long term population trend stable or increasing	Waterbird population trends are presented in part four of the conservation objectives supporting document
Distribution	Number, range, timing and intensity of use of areas	No significant decrease in the range, timing or intensity of use of areas by sanderling, other than that occurring from natural patterns of variation	Waterbird distribution from the 2010/2011 waterbird survey programme is discussed in part five of the conservation objectives supporting document

A149 Dunlin *Calidris alpina alpina*

To maintain the favourable conservation condition of Dunlin in Killala Bay/Moy Estuary SPA, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Population trend	Percentage change	Long term population trend stable or increasing	Population trends are presented in part four of the conservation objectives supporting document
Distribution	Number, range, timing and intensity of use of areas	No significant decrease in the range, timing or intensity of use of areas by dunlin, other than that occurring from natural patterns of variation	Waterbird distribution from the 2010/2011 waterbird survey programme is discussed in part five of the conservation objectives supporting document

A157 Bar-tailed Godwit *Limosa lapponica*

To maintain the favourable conservation condition of Bar-tailed Godwit in Killala Bay/Moy Estuary SPA, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Population trend	Percentage change	Long term population trend stable or increasing	Population trends are presented in part four of the conservation objectives supporting document
Distribution	Number, range, timing and intensity of use of areas	No significant decrease in the range, timing or intensity of use of areas by bar-tailed godwit, other than that occurring from natural patterns of variation	Waterbird distribution from the 2010/2011 waterbird survey programme is discussed in part five of the conservation objectives supporting document

A160 Curlew *Numenius arquata*

To maintain the favourable conservation condition of Curlew in Killala Bay/Moy Estuary SPA, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Population trend	Percentage change	Long term population trend stable or increasing	Population trends are presented in part four of the conservation objectives supporting document
Distribution	Number, range, timing and intensity of use of areas	No significant decrease in the range, timing or intensity of use of areas by curlew, other than that occurring from natural patterns of variation	Waterbird distribution from the 2010/2011 waterbird survey programme is discussed in part five of the conservation objectives supporting document

A162 Redshank *Tringa totanus*

To maintain the favourable conservation condition of Redshank in Killala Bay/Moy Estuary SPA, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Population trend	Percentage change	Long term population trend stable or increasing	Population trends are presented in part four of the conservation objectives supporting document
Distribution	Number, range, timing and intensity of use of area	No significant decrease in the range, timing or intensity of use of areas by redshank, other than that occurring from natural patterns of variation	Waterbird distribution from the 2010/2011 waterbird survey programme is discussed in part five of the conservation objectives supporting document

Conservation Objectives for : Killala Bay/Moy Estuary SPA [004036]

A999 Wetlands

To maintain the favourable conservation condition of wetland habitat in Killala Bay/Moy Estuary SPA as a resource for the regularly occurring migratory waterbirds that utilise it. This is defined by the following attribute and target:

Attribute	Measure	Target	Notes
Habitat area	Hectares	The permanent area occupied by the wetland habitat should be stable and not significantly less than the area of 3204 hectares, other than that occurring from natural patterns of variation	The wetland habitat area was estimated as 3204ha using OSi data and relevant orthophotographs. For further information see part three of the conservation objectives supporting document

Lackan Bay

KILLALA
Cill Ala

INISHCRONE
Inis Crabhann

Legend

SPA 004036

An Roinn Ealaíon, Oidhreachta agus Gaeltachta
Department of Arts, Heritage and the Gaeltacht

MAP 1:
KILLALA BAY / MOY ESTUARY SPA
CONSERVATION OBJECTIVES
SPA DESIGNATION

Map to be read in conjunction with the NPWS Conservation Objectives Document.

SITE CODE: SPA 004036
CO. MAYO; version 1.02
CO. SLIGO; version 1.02

0 0.5 1 1.5 2 km

N

Map Version 1
Date: Feb 2013

SAC 000516

SPA 004036

SPA 004036

SAC 000458

Legend

- SPA 004036
- SAC 000458 Killala Bay/Moy Estuary
- SAC 000516 Lackan Saltmarsh And Kilcummin Head
- OSi Discovery Series County Boundaries

An Roinn Ealaíon, Oidhreachta agus Gaeltachta
Department of Arts, Heritage and the Gaeltacht

MAP 2:
KILLALA BAY / MOY ESTUARY SPA CONSERVATION OBJECTIVES ADJOINING / OVERLAPPING DESIGNATIONS

Map to be read in conjunction with the NPWS Conservation Objectives Document.

SITE CODE:
SPA 004036 CO. MAYO; version 1.02, CO. SLIGO; version 1.02
SAC 000458 CO. MAYO; version 1.01, CO. SLIGO; version 1.01
SAC 000516 CO. MAYO; version 1.01

0 1 2 3 km

N

Map Version 1
Date: Feb 2013

Conservation objectives for Lough Conn and Lough Cullin SPA [004228]

The overall aim of the Habitats Directive is to maintain or restore the favourable conservation status of habitats and species of community interest. These habitats and species are listed in the Habitats and Birds Directives and Special Areas of Conservation and Special Protection Areas are designated to afford protection to the most vulnerable of them. These two designations are collectively known as the Natura 2000 network.

European and national legislation places a collective obligation on Ireland and its citizens to maintain habitats and species in the Natura 2000 network at favourable conservation condition. The Government and its agencies are responsible for the implementation and enforcement of regulations that will ensure the ecological integrity of these sites.

The maintenance of habitats and species within Natura 2000 sites at favourable conservation condition will contribute to the overall maintenance of favourable conservation status of those habitats and species at a national level.

Favourable conservation status of a habitat is achieved when:

- its natural range, and area it covers within that range, are stable or increasing, and
- 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.

The 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, and
- 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.

Objective: To maintain or restore the favourable conservation condition of the bird species listed as Special Conservation Interests for this SPA:

Bird Code	Common Name	Scientific Name
A061	Tufted Duck	*Aythya fuligula*
A065	Common Scoter	*Melanitta nigra*
A182	Common Gull	*Larus canus*
A395	Greenland White-fronted Goose	*Anser albifrons flavirostris*

To acknowledge the importance of Ireland's wetlands to wintering waterbirds, “Wetland and Waterbirds” may be included as a Special Conservation Interest for some SPAs that have been

designated for wintering waterbirds and that contain a wetland site of significant importance to one or more of the species of Special Conservation Interest. Thus, a second objective is included as follows:

Objective: To maintain or restore the favourable conservation condition of the wetland habitat at Lough Conn and Lough Cullin SPA as a resource for the regularly-occurring migratory waterbirds that utilise it.

Citation: *NPWS (2018) Conservation objectives for Lough Conn and Lough Cullin SPA [004228]. Generic Version 6.0. Department of Culture, Heritage and the Gaeltacht.*

Appendix B

Nutrient Sensitive Qualifying Interests

Code	Qualifying Interest	Code	Qualifying Interest	Code	Qualifying Interest
A001	Red-throated Diver (Gavia stellata)	A160	Curlew (Numenius arquata)	1130	Estuaries
A003	Great Northern Diver (Gavia immer)	A162	Redshank (Tringa totanus)	1140	Tidal mudflats
A004	Little Grebe (Tachybaptus ruficollis)	A164	Greenshank (Tringa nebularia)	1150	Lagoons*
A005	Great Crested Grebe (Podiceps cristatus)	A169	Turnstone (Arenaria interpres)	1160	Large shallow inlets and bays
A013	Manx Shearwater (Puffinus puffinus)	A179	Black-headed Gull (Larus ridibundus)	1170	Reefs
A014	Storm Petrel (Hydrobates pelagicus)	A182	Common Gull (Larus canus)	1210	Annual vegetation of drift lines
A016	Gannet (Morus bassanus)	A183	Lesser Black-backed Gull (Larus fuscus)	1230	Sea cliffs
A017	Cormorant (Phalacrocorax carbo)	A184	Herring Gull (Larus argentatus)	1310	Salicornia mud
A018	Shag (Phalacrocorax aristotelis)	A188	Kittiwake (Rissa tridactyla)	1330	Atlantic salt meadows
A028	Grey Heron (Ardea cinerea)	A199	Guillemot (Uria aalge)	1410	Mediterranean salt meadows
A037	Bewick's Swan (Cygnus columbianus bewickii)	A200	Razorbill (Alca torda)	1420	Halophilous scrub
A038	Whooper Swan (Cygnus cygnus)	A204	Puffin (Fratercula arctica)	2110	Embryonic shifting dunes
A043	Greylag Goose (Anser anser)	A229	Kingfisher (Alcedo atthis)	2120	Marram dunes (white dunes)
A045	Barnacle Goose (Branta leucopsis)	A395	Greenland White-fronted Goose (Anser albifrons flavirostris)	2130	Fixed dunes (grey dunes)*
A046	Light-bellied Brent Goose (Branta bernicla hrota)	A466	A/A149 Dunlin (Calidris alpina)	2140	Decalcified Empetrum dunes*
A048	Shelduck (Tadorna tadorna)	1013	Geyer's whorl snail (Vertigo geyeri)	2150	Decalcified dune heath*
A050	Wigeon (Anas penelope)	1014	Narrow-mouthed whorl snail (Vertigo angustior)	2170	Dunes with creeping willow
A051	Gadwall (Anas strepera)	1016	Desmoulin's whorl snail (Vertigo moulinsiana)	2190	Dune slack
A052	Teal (Anas crecca)	1024	Kerry Slug (Geomalacus maculosus)	21A0	Machair*
A053	Mallard (Anas platyrhynchos)	1029	Freshwater Pearl Mussel (Margaritifera margaritifera)	3110	Lowland oligotrophic lakes
A054	Pintail (Anas acuta)	1092	White-Clawed Crayfish (Austropotamobius pallipes)	3130	Upland oligotrophic lakes
A056	Shoveler (Anas clypeata)	1095	Sea Lamprey (Petromyzon marinus)	3150	Natural eutrophic lakes
A061	Tufted Duck (Aythya fuligula)	1096	Brook Lamprey (Lampetra planeri)	3160	Dystrophic lakes
A062	Scaup (Aythya marila)	1099	River Lamprey (Lampetra fluviatilis)	3180	Turloughs*

Code	Qualifying Interest	Code	Qualifying Interest	Code	Qualifying Interest
A065	Common Scoter (Melanitta nigra)	1103	Twaite Shad (Alosa fallax fallax)	3260	Water courses of plain to montane levels with the Ranunculion fluitantis and Callitricho-Batrachion vegetation
A067	Goldeneye (Bucephala clangula)	1106	Atlantic Salmon (Salmo salar)	3270	Chenopodium rubri
A069	Red-breasted Merganser (Mergus serrator)	1303	Lesser Horseshoe Bat (Rhinolophus hipposideros)	6130	Calaminarian grassland
A130	Oystercatcher (Haematopus ostralegus)	1349	Bottle-Nosed Dolphin (Tursiops truncatus)	6210	Orchid-rich calcareous grassland*
A137	Ringed Plover (Charadrius hiaticula)	1351	Harbour Porpoise (Phocoena phocoena)	6410	Molinia meadows
A140	Golden Plover (Pluvialis apricaria)	1355	Otter (Lutra lutra)	6430	Hydrophilous tall herb
A141	Grey Plover (Pluvialis squatarola)	1364	Grey Seal (Halichoerus grypus)	7110	Raised bog (active)*
A142	Lapwing (Vanellus vanellus)	1365	Common Seal (Phoca vitulina vitulina)	7120	Degraded raised bogs
A143	Knot (Calidris canutus)	1421	Killarney Fern (Trichomanes speciosum)	7210	Cladium fen*
A144	Sanderling (Calidris alba)	1528	Marsh Saxifrage (Saxifraga hirculus)	7220	Petrifying springs*
A148	Purple Sandpiper (Calidris maritima)	1833	Slender Naiad (Najas flexilis)	7230	Alkaline fens
A156	Black-tailed Godwit (Limosa limosa)	1990	Nore Freshwater Pearl Mussel (Margaritifera durrovensis)	8240	Limestone pavement*
A157	Bar-tailed Godwit (Limosa lapponica)	1110	Sandbanks	8330	Sea caves
				91A0	Old oak woodlands
				91E0	Residual alluvial forests*

Appendix C

EAM Summary Report for 014 Lough Mask RWSS

Irish Water

Lead in Drinking Water Mitigation Plan - EAM

Tourmakeady EAM

257367-00

19 January 2022 Issue 7 | 19 January 2022

Job number 257367

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Document verification

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Contents

Tables

Figures

1 Introduction

This document presents the results of the implementation of the Lead Mitigation Environmental Assessment Methodology (EAM) to assess the impact of dosing part of the Tourmakeady (Lough Mask) Regional Water Supply with orthophosphate.

The assessment tracks the orthophosphate dosed drinking water from source (i.e. reservoirs), through drinking water distribution (i.e. watermains), waste water collection and treatment systems (i.e. wastewater treatment plants and septic tanks) to environmental receptors (i.e. river water, groundwater, lake, and transitional waterbodies). The orthophosphate load that by-passes the wastewater treatment plants (i.e. through leakages and storm overflows) are also included in the assessment.

The assessment methodology is described in full in RPS (2016) *Irish Water – Lead in Drinking Water Mitigation Plan. Environmental Assessment Methodology*.

The assessment includes processing steps in Graphic Information System (GIS) and excel. The assessment also draws upon the following source data:

- Results of the Plumbosolvency reports by Ryan Hanley.
- Results of pre-processing GIS work to generate regional input files.
- Data relating to Waste Water Treatment Plants (WWTP) from Annual Environmental Reports (AER) and the Environmental Protection agency (EPA) web-based WFD App which is accessed through their Eden Portal.
- Data relating to water body monitoring and characterisation from the EPA WFD App downloaded on the 10th January 2021.
- Data relating to rainfall and catchment areas from the OPW Flood Studies Update (FSU) Portal.
- GIS data river segment data providing river flows from the EPA “hydrotool data”.
- Gauge data providing river flows from the EPA web-based HydroNet.

2 Abbreviations & Glossary

- AER – Annual Environmental Report
- Agglomeration- the catchment of the WWTP
- DWWTS -Domestic Waste Water Treatment System
- EAM – Environmental Assessment Method
- ELV – Emission Limit Values
- EPA- Environmental Protection Agency
- FSU – Flood studies Update Portal – website hosted
- GIS - Geographic Information Systems
- GWB- Ground Water Body
- IW – Irish Water
- LWB – Lake Water Body
- OP- Orthophosphate
- PE- Population Equivalent or unit per capita loading in waste-water treatment. PE can be considered the estimated number of people required to produce a measured load (e.g. of organic matter, water or P) at the WWTP
- RWB – River Water Body
- SAAR - Standard-period Average Annual Rainfall method. The 30%ile flow for the river catchment is calculated using the catchment area and the SAAR value at the catchment outlet point. The area of the total river catchment is calculated using the Water Framework Directive App defined river subbasin GIS layer. The SAAR value is from the OPW FSU portal.
- SWO- Storm Water Overflow
- TP- Total Phosphorus
- TraC – Transitional and Coastal
- WFD- Water Framework Directive
- WSZ - Water Supply Zone
- WWTP – Waste Water Treatment Plant

3 Tourmakeady and Related Water Supply Zones

Tourmakeady WTP in South East Co Mayo supplies two reservoirs, Castlebar Reservoir and Sandyhill Reservoir. The Plumbosolvency Report prepared in relation to the Lough Mask RWSS proposes that Orthophosphate is dosed at the outlets from these two reservoirs. Figure 1 below shows the location of the water supply zones serviced by the two reservoirs.

The average flows from the Castlebar and Sandyhill Reservoirs are 7,500 m^3/day and 3,319 m^3/day respectively. Approximately 35% of the flow is accounted for and this fixed rate for water mains leakage is assumed for both Water Supply Zones (WSZs). The WSZ boundaries cover a large rural area and the Castlebar and Westport urban centres which are served by agglomerations. The boundary of the Castlebar WSZ reaches the outskirts of Westport and some of the Castlebar WSZ area is served by the Westport Agglomeration. There are an estimated 2,127 properties across the WSZs that are serviced by DWWTS.

Water Supply Zone	**Castlebar (2200PUB1018) Westport (2200PUB1025)**
Step 1 – Appropriate Assessment Screening	*To be completed by Ryan Hanley*
Model Assumptions	All concentration and loading units for orthophosphate (PO_4-P) are expressed as mg/l P and kg P/yr. Adopted Orthophosphate Optimum Dosing Concentration is 0.6 mg/l P. Unaccounted for water from the mains is 65%. Seepage from the mains is distributed evenly across the entire length of the WSZ network. The water consumption per person has been assigned as 125 litres per day in order to calculate the direct discharges to surface water with 2.7 people per household. The water discharge per person is assigned as 105 litres per day for the discharge to DWWTS with 2.7 persons per household. Conversion factor for Total Phosphorus (TP) to Orthophosphate (P) for WWTP effluent is 0.5. It is assumed there will be no treatment of additional OP load for WWTPs with secondary, primary or no treatment. For plants with tertiary treatment it is assumed all the additional load will be treated. Where a tertiary plant is in exceedance of its ELV for TP or OP then the ability of the plant to treat the additional load is confirmed with Irish Water. Where IW indicates a tertiary plant has not remaining treatment capacity it will be assumed the entire additional load is not treated.

	Where existing monitoring data is not available a surrogate status is derived from the Orthophosphate indicative quality of the waterbody in the following hierarchy: • Upstream waterbodies • Downstream waterbodies • Adjacent waterbodies of similar hydrological settings • Ecological status of the waterbody. The mid-point of that surrogate indicative quality range is used as baseline concentration.
Step 2 & 3 – Impact on Waste Water Treatment Plant (WWTP) Effluent Concentrations and receiving WBs	This section assesses the influent and effluent P loads and resultant OP dosages at WWTP within the WSZ before and after dosing. Inputs to and results of the Step 2 assessment for individual WWTP are given in Table 1. Where an agglomeration includes SWOs, discharges from this source are included. Emission Limit Value (ELVs) are assigned for WWTPs to protect the receiving River Waterbodies (RWB) from direct discharges during low flows. Where ELVs are in force these are shown in Table 1. WWTPs that are failing to comply with their ELVs are also indicated. The treatment level and PE of the WWTPs within the agglomerations are as follows; - Castlebar – Tertiary treatment PE 17,550 - Westport – Secondary treatment PE 11,207 - Turlough – Secondary treatment PE 340 A sensitivity analysis was carried out on the conversion between Orthophosphate and Total Phosphorus at three factors; 0.4, 0.5 and 0.68. The results of the assessment are presented in Table 1.
Step 4 - Subsurface pathways	The loading from the mains leakage is calculated at 6,999 m^3/d (1,533 kg P/yr). Approximately 1,351 kg P/yr of the load is attenuated along the flowpaths. The hydraulic loading from the DWWTS is 474 m^3/d (132 kg P/yr). Approximately 1730 kg P/yr of the load is attenuated along the flowpaths. Flow monitoring gauges are available for one waterbody. The remaining river flows for receiving water bodies are established from Hydrotool data or, if that is not available, using the Area-SAAR method. Baseline Orthophosphate monitoring data and associated thresholds are available for 12 of the 18 RWBs with the exception of Claureen (Mayo)_010, Cloghan_010, Clonkeen_010, Glenisland_010, Mayour_010 and Crumlin (Lough Cullin)_010. Orthophosphate drinking water dosing does not lead to a deterioration in RWB status from subsurface and near surface pathways.
Step 5 and 6 - Combined Impact from direct and diffuse sources on River	This section assesses the combined impact as a result of increased Orthophosphate load from WWTP discharges (Steps 2 & 3), seepage from mains and DWWTS. Figure 2 illustrates the scale of Orthophosphate loading to the receiving water bodies from mains leakage, DWWTS and direct

Waterbodies (RWB)	discharges from WWTP and SWOs. This illustrates that a significant proportion of the loads come from mains leakage through the subsurface and near surface pathways. Figure 3 presents the total loading to the dosing area from the four main sources and illustrates how much of the loading is attenuated in the subsurface, treated in WWTPs and ultimately how much is transported to the receiving RWBs. This illustrated that mains leakage and primary discharge account for the largest proportion of load and a large proportion of the mains leakage is attenuated. Direct discharges from WWTPs are combined with diffuse discharges at the following receiving waterbodies and tracked downstream from that point: Castlebar WWTP – Castlebar_020 RWB Turlough WWTP – Castlebar_020 RWB The increase in Orthophosphate concentrations due to dosing is shown in Table 2. The increase in concentration as a result of the Orthophosphate dosing does not cause the deterioration in the status of any RWB.
Step 5 and 6 - Combined Impact through subsurface and surface pathways on Groundwater Waterbodies (GWB)	The increase in Orthophosphate concentrations in the GWBs as a result of the OP dosing is shown in Table 3. There is no monitoring data for five of seven groundwater bodies and therefore the surrogate indicative upper and lower thresholds were applied. The good status was applied based on the indicative WFD app classification. Monitoring data is available for Swinford and Foxford GWBs. Impact from orthophosphate dosing on groundwater bodies does not lead to a reduction in GWB status.
Step 5 and 6 - Combined Impact from direct and diffuse sources on Lakes within the Water Supply Zone	The increase in Orthophosphate concentrations in the Lake Waterbodies (LWB) as a result of the drinking water dosing is shown in Table 4. There are seven lakes water bodies of which three are monitored. There is no monitoring data available for Clogher MO, Doo Westport, Islandeady and Derryhick. The increase in concentration as a result of the Orthophosphate dosing does not cause the deterioration in the status of any lake WBs.
Step 5 and 6 - Combined Impact from direct and diffuse sources on Transitional Water Bodies	The increase in Orthophosphate concentrations in the downstream Transitional Waterbodies and small Coastal (TraC) Waterbodies as a result of drinking water dosing is shown in Table 5. Baseline Orthophosphate monitoring data and associated thresholds are available for all the transitional and coastal water bodies with the exception of Westport Bay in winter, Newport Bay in winter, Inner clew bay in the winter and Killala Bay.

	Direct discharges from WWTPs are combined with diffuse discharges at the following receiving waterbodies: Westport WWTP –Westport Bay The increase in concentration as a result of the Orthophosphate dosing does not cause the deterioration in the status of any TraC waterbody.
Step 5 and 6 Cumulative Assessment of impact from upstream EAMs on Transitional and Coastal (TraC) Water Bodies	<u>Step 5 and 6 Cumulative Assessment of impact from all EAMs within catchment on Transitional and Coastal Waterbodies</u> A cumulative assessment was undertaken to assess the impact on TraC WBs from all the contributing EAMs. The assessment is carried out on a catchment scale. <u>Corrib and Galway Bay South East</u> The following EAMs are within the Galway Bay South East catchment and contribute to the same TraC WBs as Tourmakeady, see Figure 4: 007 Terryland 012 Tuam 170 Gort 189. Achill 209 Kinvara Williamstown (RPS) Ballinlough/Loughglynn (Ballybane Springs) (RPS) A negligible quantity of OP from the current scheme (0.6kg/yr) enters the Corrib system through the Claureen (Mayo)_010. This inputs rapidly falls to <1% of the total OP load in potentially impacted waters. Dosages due to total loads are below levels of significance. The increase in Orthophosphate concentrations in the downstream TraC WBs as a result of the drinking water dosing of all EAMs with Orthophosphate is shown in Table 6. <u>Moy and Killala Bay</u> The following EAM dosing areas are within the Moy and Killala Bay Catchment and discharge to the same TraC WBs as the Ballina Lisglennon EAM: 014 Tourmakeady 045. Lough Talt 056 Lisglennon 217 Swinford 247 Kiltimagh 289 Charlestown Lough Gara (RPS) The increase in Orthophosphate concentrations in the downstream TraC WBs as a result of the drinking water dosing of all four EAMs with Orthophosphate is shown in Table 6. <u>Step 5 and 6 Cumulative Assessment of impact from EAMs on downstream Protected Waterbodies</u>

	The cumulative load from this dosing area and any upstream dosing area was tracked downstream to determine the potential concentration increase in any RWBs and LWBs which are Special Areas of Conservation (SAC). The increase in Orthophosphate concentrations in the waterbodies (WBs) as a result of the P drinking water dosing is shown in Table 7 The results show there is no deterioration in WB status downstream of the EAM. The results that there will be no discernible increase (i.e. above 0.00125mg/l P) in any of the downstream SAC RWBs.
Conclusions	**Red, Amber, Green (RAG) STATUS: EAM Result – GREEN** The purpose of the RAG status is to indicate the waterbodies that are failing the EAM assessment on a map. Any waterbodies failing the EAM model will be marked as **Amber** in the interim while further analysis is being completed, where the further analysis confirms the water body is failing the water body will be coloured **Red**. If the EAM indicates there will not be a deterioration in the waterbody status as a result of drinking water dosing it will remain **Green**. A map of the RAG status of waterbodies is presented in Figure 5.
Recommendation	No recommendations are required

Table 1: Increased loading/concentration from WWTPs due to dosing of drinking water – Dosing rate = 0.6 mg/l P

Agglomeration and Discharge Type	Treatment Level	ELV from WWDL	Receiving Water Body		TP Load kg/yr P	Ortho P Concentration mg/l P TP – Ortho P Conversion factor varied for sensitivity analysis (40%, 50%, 68%)		
						0.5	0.4	0.68
Castlebar Primary Discharge	Tertiary	Total Phosphate 2mg/l TP-Compliant	Castlebar_020	Existing	542	0.07	0.06	0.10
				Post Dosing	542	0.07	0.06	0.10
Castlebar SWOs (1 No.)		Orthophosphate 0.7mg/l P - Compliant		Existing	326	0.21	0.17	0.29
				Post Dosing	339	0.22	0.18	0.30
Westport Primary Discharge	Secondary	No ELV	Westport Bay	Existing	1304	0.33	0.26	0.45
				Post Dosing	1550	0.39	0.31	0.53
Westport SWOs (1 No.)				Existing	194	0.24	0.19	0.33
				Post Dosing	201	0.25	0.20	0.34
Turlough Primary Discharge	Secondary	No ELV	Castlebar_020	Existing	116	3.74	2.99	5.08
				Post Dosing	128	4.12	3.30	5.60

Table 2: Orthophosphate concentrations in river waterbodies following dosing of drinking water

Name	**EU_ CD**	**Indicative Quality** *Surrogate Status in italic*	**Baseline conc. (mg/l P)**	**75% status threshold (mg/l P)**	**Cumulative load (kg/yr P)**	**Modelled dosing conc. (mg/l P)**	**Potential Baseline conc. following dosing (mg/l P)**
Claureen (mayo)_010	IE_WE_30C120400	*High*	0.0125	0.0188	0.6	0.00002	0.0125
Carrowbeg (westport)_020	IE_WE_32C050100	High	0.0078	0.0188	1.6	0.00004	0.0078
Carrowbeg (westport)_030	IE_WE_32C050300	High	0.0070	0.0188	14.4	0.0003	0.0073
Cloghan_010	IE_WE_32C160630	*High*	0.0125	0.0188	20.4	0.0023	0.0148
Cloonkeen_010	IE_WE_32C380790	*High*	0.0125	0.0188	11.8	0.0008	0.0133
Glenisland_010	IE_WE_32G070300	*High*	0.0125	0.0188	13.6	0.0007	0.0132
Moyour_010	IE_WE_32M010700	*High*	0.0125	0.0188	6.5	0.0001	0.0126
Newport (mayo)_010	IE_WE_32N010020	High	0.0072	0.0188	15.6	0.0001	0.0073
Owennabrockagh_010	IE_WE_32O040500	High	0.0059	0.0188	6.9	0.0003	0.0062
Castlebar_010	IE_WE_34C010180	High	0.0057	0.0188	40.6	0.0005	0.0062
Castlebar_020	IE_WE_34C010300	Moderate	0.0075	0.0508	69.8	0.0007	0.0082
Castlebar_030	IE_WE_34C010400	Moderate	0.0125	0.0508	93.0	0.0003	0.0128
Castlebar_040	IE_WE_34C010500	High	0.0107	0.0188	119.5	0.0003	0.0110
Clydagh (castlebar)_010	IE_WE_34C050100	High	0.0058	0.0188	17.6	0.0005	0.0063
Clydagh (castlebar)_020	IE_WE_34C050200	High	0.0063	0.0188	26.2	0.0005	0.0068
Crumlin (lough cullin)_010	IE_WE_34C110300	*Moderate*	0.0455	0.0508	10.0	0.0003	0.0458
Manulla_030	IE_WE_34M010300	High	0.0139	0.0188	14.3	0.0001	0.0140
Manulla_040	IE_WE_34M010500	High	0.0116	0.0188	16.5	0.0001	0.0117

Table 3: Orthophosphate concentrations in groundwater waterbodies following dosing of drinking water

Name	EU_CD	Indicative Quality *Surrogate Status in italic*	Baseline conc. (mg/l P)	75% status threshold (mg/l P)	Cumulative load (kg/yr P)	Modelled dosing conc. (mg/l P)	Potential Baseline conc. following dosing (mg/l P)
Clifden Castlebar	IE_WE_G_0017	*Good*	0.0175	0.0263	2.8	0.00003	0.0175
Aghagower	IE_WE_G_0021	*Good*	0.0175	0.0263	1.2	0.0001	0.0176
Ballyhean	IE_WE_G_0022	*Good*	0.0175	0.0263	0.5	0.00001	0.0175
Newport	IE_WE_G_0023	*Good*	0.0175	0.0263	20.6	0.0007	0.0182
Beltra Lough South	IE_WE_G_0024	*Good*	0.0175	0.0263	0.03	0.000002	0.0175
Swinford	IE_WE_G_0033	Good	0.0070	0.0263	57.9	0.0003	0.0073
Foxford	IE_WE_G_0034	Good	0.0050	0.0263	5.3	0.0001	0.0051

Table 4: Total Phosphorus concentrations in lake waterbodies following dosing of drinking water

Name	EU_CD	Indicative Quality *Surrogate Status in italic*	Baseline conc used in calculation (mg/l TP)	75% of status threshold (mg/l TP)	Cumulative load (kg/yr TP)	Modelled dosing conc. (mg/l TP)	Potential Baseline conc. following dosing (mg/l TP)
Clogher MO	IE_WE_32_450	*High*	0.0050	0.0075	6.5	0.0001	0.0051
Beltra	IE_WE_32_452	Good	0.0129	0.0213	15.6	0.0001	0.0130
Doo Westport	IE_WE_32_463	*High*	0.0050	0.0075	6.5	0.0001	0.0051
Islandeady	IE_WE_34_376	*High*	0.0050	0.0075	40.6	0.0005	0.0055
Derryhick	IE_WE_34_386	*High*	0.0050	0.0075	10.0	0.0003	0.0053
Castlebar	IE_WE_34_403	Good	0.0223	0.0213	40.6	0.0005	0.0228*
Cullin	IE_WE_34_406a	Good	0.0115	0.0213	13.3	0.0005	0.0119

*Baseline concentration > 75% of threshold but dosing concentration is insignificant.

Table 5: Orthophosphate concentrations in transitional waterbodies and small coastal waterbodies following dosing of drinking water

Name	EU_CD	Season	Indicative Quality *Surrogate Status in italic*	Baseline conc used in calculation (mg/l P)	75% of status threshold (mg/l P)	Cumulative load (kg/yr P)	Modelled dosing conc. (mg/l P)	Potential Baseline conc. following dosing (mg/l P)
Corrib Estuary	IE_WE_170_0700	Summer	High	0.0051	0.0188	0.6	0.0000003	0.0051
		Winter	High	0.0110	0.0188	0.6	0.0000003	0.0110
Inner Galway Bay North	IE_WE_170_0000	Summer	High	0.0025	0.0188	0.6	0.0000002	0.0025
		Winter	High	0.0125	0.0188	0.6	0.0000002	0.0125
Westport Bay	IE_WE_350_0100	Summer	High	0.0075	0.0188	161.4	0.0002	0.0077
		Winter	*High*	0.0125	0.0188	161.4	0.0002	0.0127
Newport Bay	IE_WE_350_0200	Summer	High	0.0060	0.0188	15.6	0.0001	0.0061
		Winter	*High*	0.0125	0.0188	15.6	0.0001	0.0126
Moy Estuary	IE_WE_420_0300	Summer	High	0.0120	0.0188	129.4	0.0001	0.0121
		Winter	High	0.0070	0.0188	129.4	0.0001	0.0071
Inner Clew Bay	IE_WE_350_0000	Summer	High	0.0084	0.0188	177.0	0.0001	0.0085
		Winter	*High*	0.0125	0.0188	177.0	0.0001	0.0126
Killala Bay	IE_WE_420_0000	Summer	*High*	0.0125	0.0188	129.4	0.00005	0.0125
		Winter	*High*	0.0125	0.0188	129.4	0.00005	0.0125

Table 6: Cumulative assessment of orthophosphate concentrations in transitional and coastal water bodies following dosing of drinking water

Name	**EU_CD**	**Season**	**Indicative Quality** *Surrogate Status in italic*	**Baseline conc used in calculation (mg/l P)**	**75% of status threshold (mg/l P)**	**Load, (kg/yr P) from current EAM**	**Cumulative load (kg/yr P)**	**Modelled dosing conc. (mg/l P)**	**Potential Baseline conc. following dosing (mg/l P)**
Corrib Estuary	IE_WE_170_0700	Summer	High	0.0051	0.0188	0.6	3451.5	0.0017	0.0068
		Winter	High	0.0110	0.0188	0.6	3451.5	0.0017	0.0127
Inner Galway Bay North	IE _WE_170_0000	Summer	High	0.0025	0.0188	0.6	3579.8	0.0016	0.0041
		Winter	High	0.0125	0.0188	0.6	3579.8	0.0016	0.0141
Moy Estuary	IE_WE_420_0300	Summer	High	0.0120	0.0188	129.4	480.7	0.0002	0.0122
		Winter	High	0.0070	0.0188	129.4	480.7	0.0002	0.0072
Killala Bay	IE_WE_420_0000	Summer	*High*	0.0125	0.0188	129.4	589.5	0.0002	0.0127
		Winter	*High*	0.0125	0.0188	129.4	589.5	0.0002	0.0127

Table 7: Orthophosphate concentrations in downstream Protected waterbodies following dosing of drinking water

Name	**EU_CD**	**Indicative Quality** *Surrogate Status in italic*	**Baseline Conc. (mg/l P)**	**75% of status threshold (mg/l P)**	**Cumulative load (kg/yr P)**	**Modelled dosing conc. (mg/l P)**	**Potential conc. following dosing (mg/l P)**
Gweestion_020	IE_WE_34G030200	High	0.0093	0.0188	17.6	0.0001	0.0093
Moy_080	IE_WE_34M020650	High	0.0104	0.0188	208.6	0.0003	0.0106
Moy_090	IE_WE_34M020750	High	0.0121	0.0188	208.6	0.0003	0.0123
Moy_100	IE_WE_34M020800	Moderate	0.0073	0.0508	372.1	0.0002	0.0074
Moy_110	IE_WE_34M020850	High	0.0086	0.0188	372.6	0.0002	0.0088
Moy_120	IE_WE_34M021100	High	0.0071	0.0188	409.1	0.0002	0.0073
Aille (Mayo)_040	IE_WE_30A020400	High	0.0067	0.0188	0.6	0.000003	0.0067

Name	EU_CD	Indicative Quality *Surrogate Status in italic*	Baseline Conc. (mg/l P)	75% of status threshold (mg/l P)	Cumulative load (kg/yr P)	Modelled dosing conc. (mg/l P)	Potential conc. following dosing (mg/l P)
Cong Canal_010	IE_WE_30C060300	High	0.0061	0.0188	0.6	0.000001	0.0061
Corrib_010	IE_WE_30C020300	High	0.0065	0.0188	202.2	0.0001	0.0066
Corrib_020	IE_WE_30C020600	High	0.0123	0.0188	252.5	0.0001	0.0124

Table 8: Total Phosphorus concentrations in downstream Protected lake waterbodies following dosing of drinking water

Name	EU_CD	Indicative Quality *Surrogate Status in italic*	Baseline Conc. (mg/l P)	75% of status threshold (mg/l P)	Cumulative load (kg/yr P)	Modelled dosing conc. (mg/l P)	Potential Baseline Total conc. following dosing (mg/l P)
Cloon MO	IE_WE_30_328	*High*	0.0050	0.0075	0.6	0.000003	0.0050
Mask	IE_WE_30_665a	High	0.0087	0.0075	0.6	0.000001	0.0087*
Corrib Upper	IE_WE_30_666b	High	0.0066	0.0075	202.2	0.0001	0.0067
Corrib Lower	IE_WE_30_666a	High	0.0076	0.0075	202.2	0.0001	0.0077*

*Baseline concentration > 75% of threshold but dosing concentration is insignificant.

Figure 1: Dosing areas in the Tourmakeady (Lough Mask) RWSS

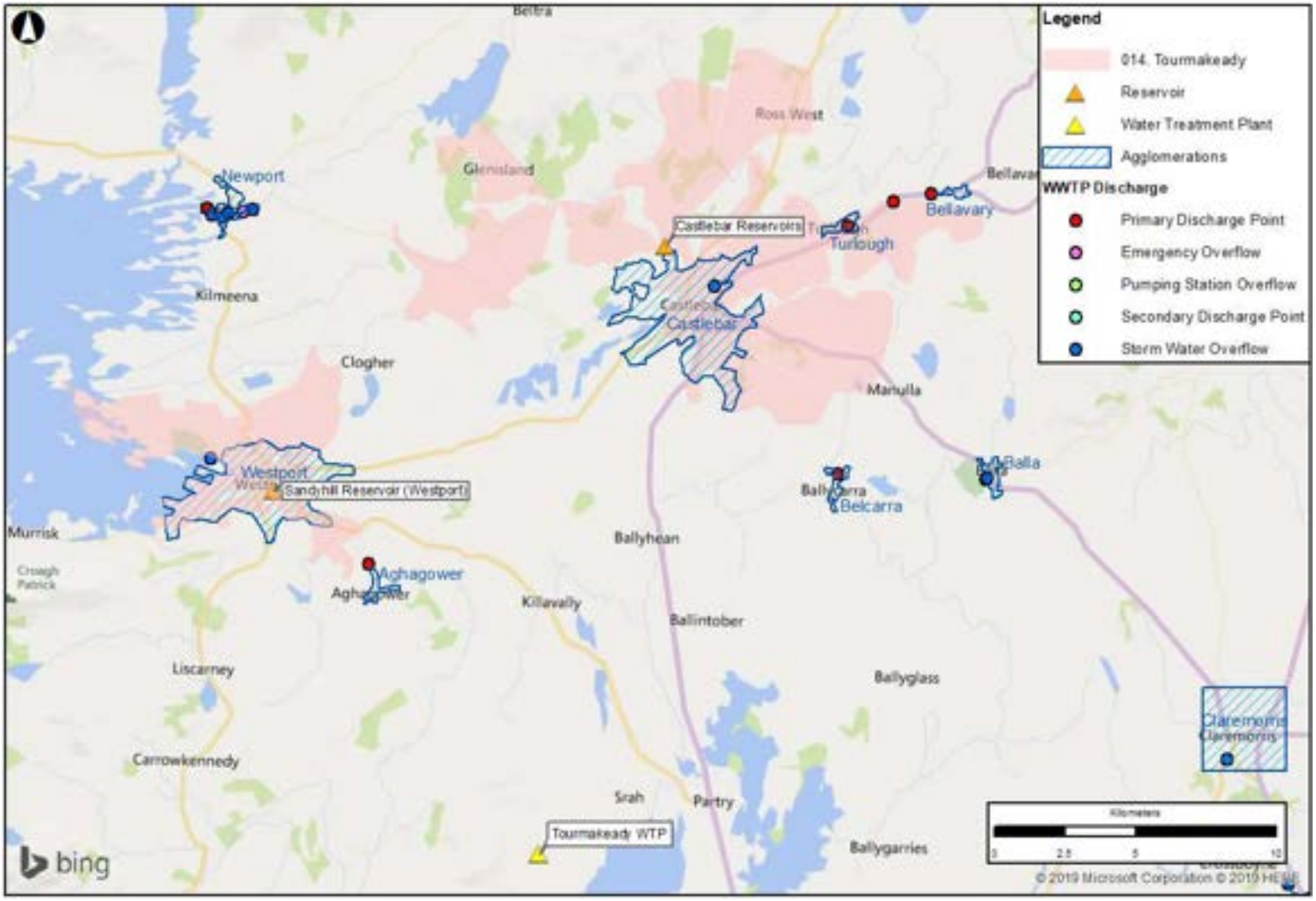

Figure 2: RWB Cumulative load assessment

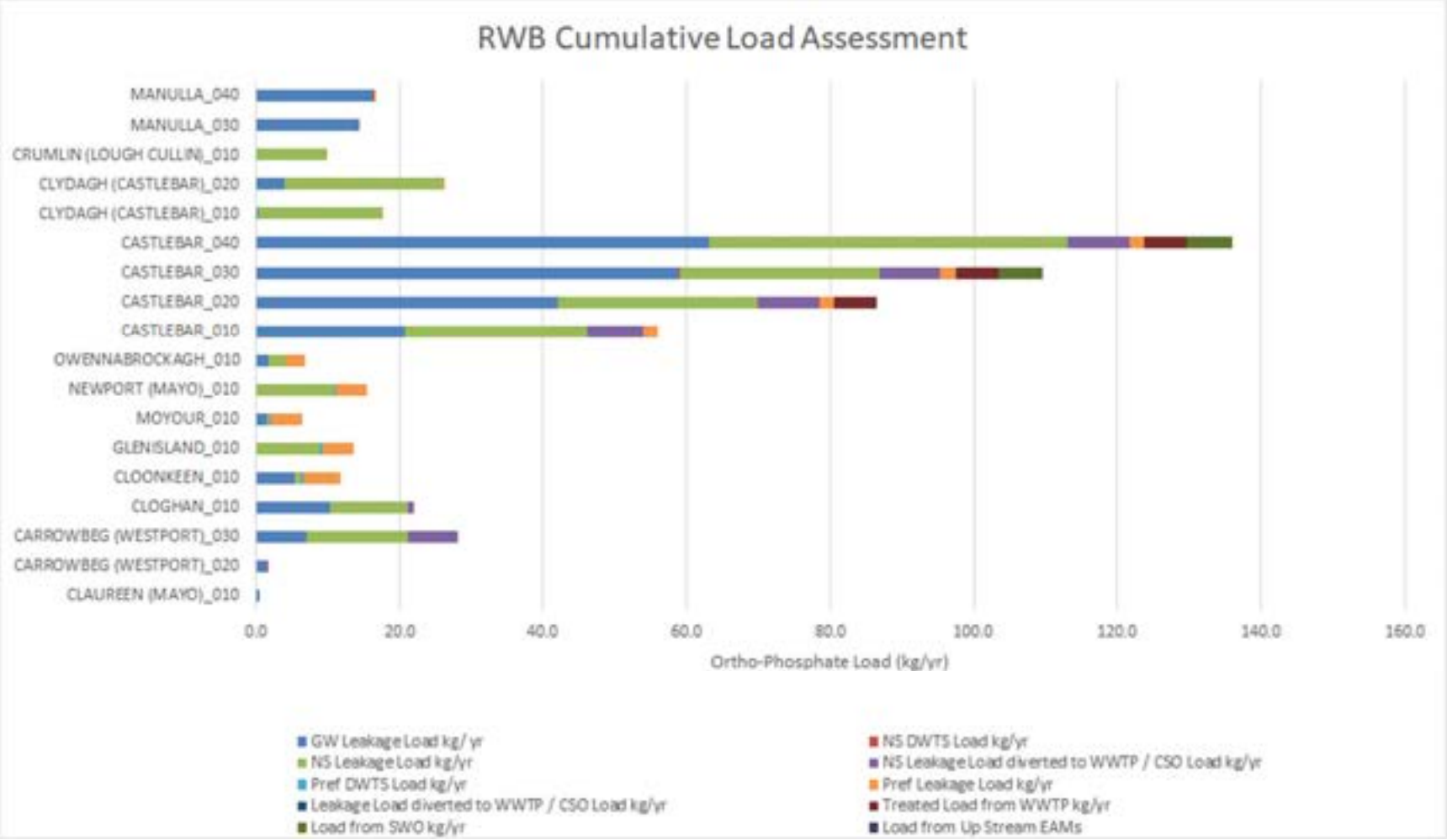

Figure 3: Total dosing area Attenuated, Treated and Transported Loads

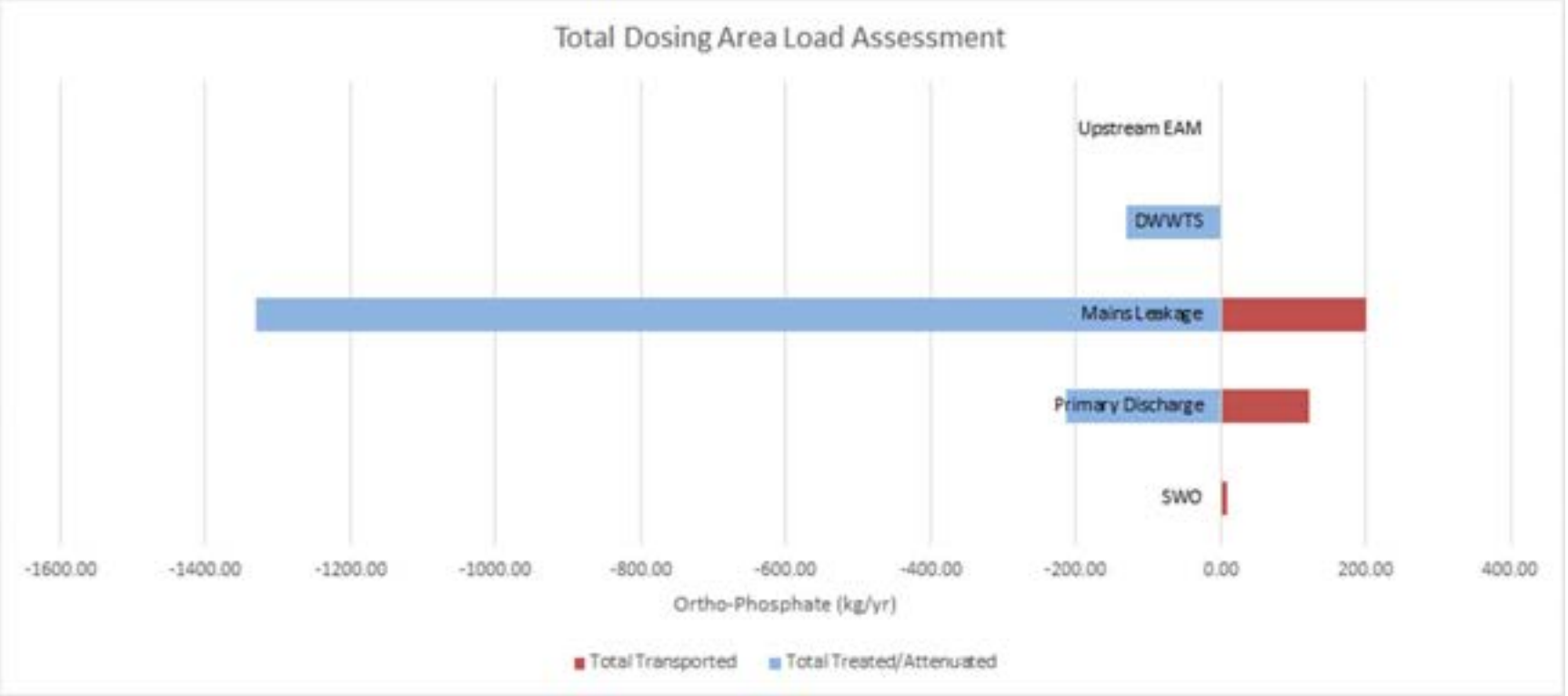

Figure 4: Upstream and downstream EAMs within WFD catchment

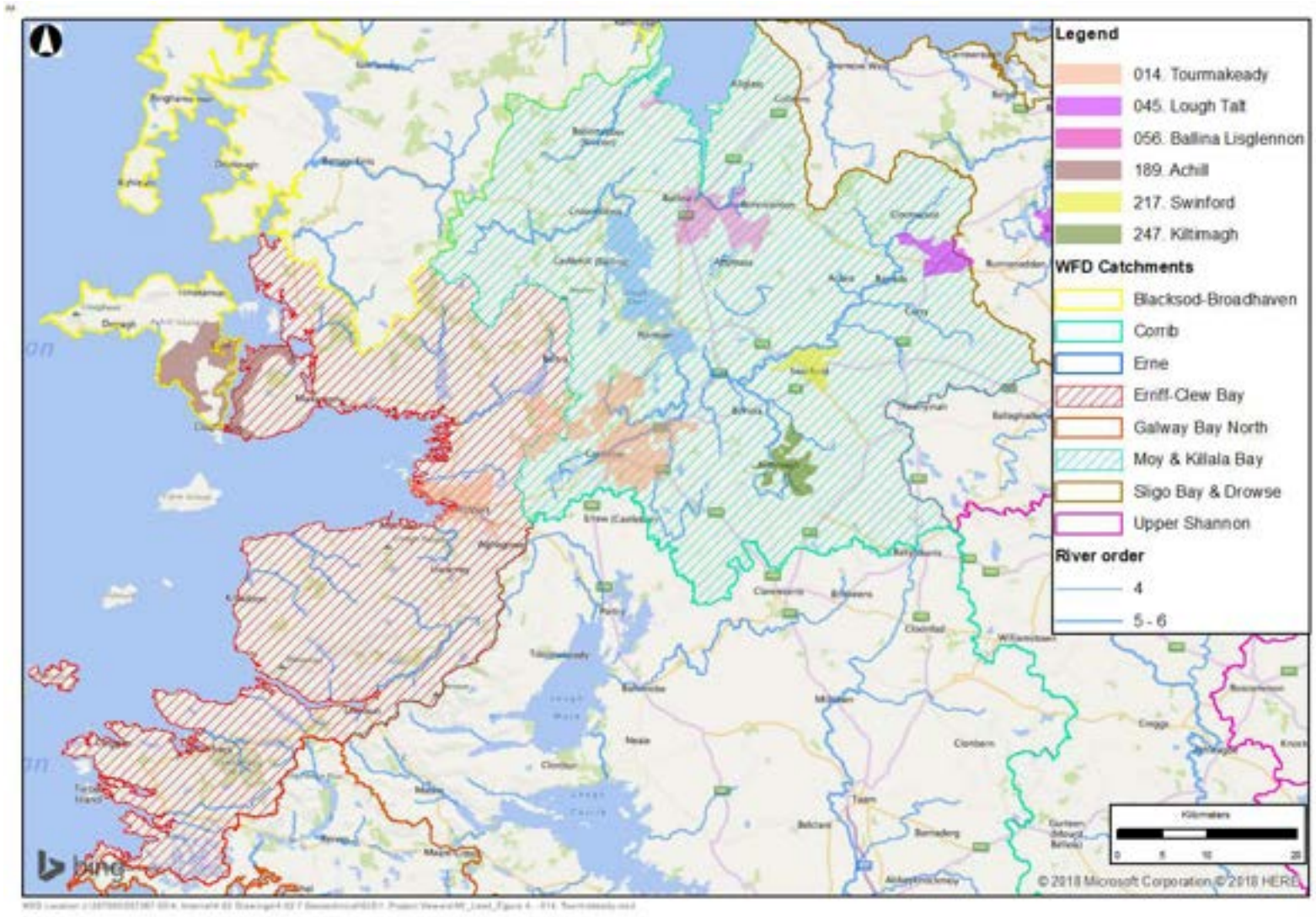

Figure 5: Red, Amber, Green (RAG) Status of waterbodies