

# National Parks and Wildlife Service

## *Conservation Objectives Series*

Lough Rea SAC 000304



An Roinn Cultúir,  
Oidhreacht agus Gaeltachta  
Department of Culture,  
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*

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000304      Lough Rea SAC

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3140      Hard oligo-mesotrophic waters with benthic vegetation of *O<sup>+</sup>detraspp.*

**Please note that this SAC overlaps with Lough Rea SPA (004134). See map 2. The conservation objectives for this site should be used in conjunction with those for the overlapping site as appropriate.**

## Supporting documents, relevant reports & publications

Supporting documents, NPWS reports and publications are available for download from: [www.npws.ie/Publications](http://www.npws.ie/Publications)

### NPWS Documents

<b>Year :</b>	1984
<b>Title :</b>	A report on the wetland vegetation of the Dunkellin/Lavelly River Catchment
<b>Author :</b>	Lockhart, N.D.
<b>Series :</b>	Unpublished report
<b>Year :</b>	2013
<b>Title :</b>	A survey of the benthic macrophytes of three hard-water lakes: Lough Bunny, Lough Carra and Lough Owel
<b>Author :</b>	Roden, C.; Murphy, P.
<b>Series :</b>	Irish Wildlife Manuals, No. 70
<b>Year :</b>	2013
<b>Title :</b>	The status of EU protected habitats and species in Ireland. Volume 2. Habitats assessments
<b>Author :</b>	NPWS
<b>Series :</b>	Conservation assessments
<b>Year :</b>	2015
<b>Title :</b>	Habitats Directive Annex I lake habitats: a working interpretation for the purposes of site-specific conservation objectives and Article 17 reporting
<b>Author :</b>	O Connor, Á.
<b>Series :</b>	Unpublished document by NPWS
<b>Year :</b>	2018
<b>Title :</b>	A report on the 2018 fieldwork undertaken as part of the hard water lake monitoring survey for NPWS
<b>Author :</b>	Roden, C.; Murphy, P.
<b>Series :</b>	Unpublished report to NPWS

### Other References

<b>Year :</b>	1982
<b>Title :</b>	Eutrophication of waters. Monitoring assessment and control
<b>Author :</b>	OECD
<b>Series :</b>	OECD, Paris
<b>Year :</b>	2000
<b>Title :</b>	Colour in Irish lakes
<b>Author :</b>	Free, G.; Allott, N.; Mills, P.; Kennelly, C.; Day, S.
<b>Series :</b>	Verhandlungen Internationale Vereinigung für theoretische und angewandte Limnologie, 27: 2620-2623
<b>Year :</b>	2006
<b>Title :</b>	A reference-based typology and ecological assessment system for Irish lakes. Preliminary investigations. Final report. Project 2000-FS-1-M1 Ecological assessment of lakes pilot study to establish monitoring methodologies EU (WFD)
<b>Author :</b>	Free, G.; Little, R.; Tierney, D.; Donnelly, K.; Coroni, R.
<b>Series :</b>	Environmental Protection Agency, Wexford
<b>Year :</b>	2009
<b>Title :</b>	The marl lakes of the British Isles
<b>Author :</b>	Pentecost, A.
<b>Series :</b>	Freshwater Reviews, 2(1): 167-197

<b>Year :</b>	2010
<b>Title :</b>	Water Quality in Ireland 2007-2009
<b>Author :</b>	McGarrigle, M.; Lucey, J.; Ó Cinnéide, M.
<b>Series :</b>	Environmental Protection Agency, Wexford
<b>Year :</b>	2012
<b>Title :</b>	A survey of 25 Marl Lakes. Internal draft
<b>Author :</b>	Roden, C.; Murphy, P.
<b>Series :</b>	Unpublished report to NPWS
<b>Year :</b>	2015
<b>Title :</b>	Water Quality in Ireland 2010-2012
<b>Author :</b>	Bradley, C.; Byrne, C.; Craig, M.; Free, G.; Gallagher, T.; Kennedy, B.; Little, R.; Lucey, J.; Mannix, A.; McCreesh, P.; McDermott, G.; McGarrigle, M.; Ní Longphuirt, S.; O'Boyle, S.; Plant, C.; Tierney, D.; Trodd, W.; Webster, P.; Wilkes, R.; Wynne, C.
<b>Series :</b>	Environmental Protection Agency, Wexford
<b>Year :</b>	2016
<b>Title :</b>	A narrative for conserving freshwater and wetland habitats in England
<b>Author :</b>	Mainstone, C.; Hall, R.; Diack, I.
<b>Series :</b>	Natural England Research Reports Number 064
<b>Year :</b>	2016
<b>Title :</b>	Lake ecological assessment metrics in Ireland: relationships with phosphorus and typology parameters and the implications for setting nutrient standards
<b>Author :</b>	Free, G.; Tierney, D.; Little, R.; Kelly, F.L.; Kennedy, B.; Plant, C.; Trodd, W.; Wynne, C.; Caroni R.; Byrne, C.
<b>Series :</b>	Biology and Environment: Proceedings of the Royal Irish Academy, 116B: 191-204
<b>Year :</b>	2017
<b>Title :</b>	Water Quality in Ireland 2010-2015
<b>Author :</b>	Fanning, A.; Craig, M.; Webster, P.; Bradley, C.; Tierney, D.; Wilkes, R.; Mannix, A.; Treacy, P.; Kelly, F.; Geoghegan, R.; Kent, T.; Mageean, M.
<b>Series :</b>	Environmental Protection Agency, Wexford

## Spatial data sources

**Year :** 2008

**Title :** OSi 1:5000 IG vector dataset

**GIS Operations :** WaterPolygons feature class clipped to the SAC boundary. Expert opinion used to identify Annex I habitat and to resolve any issues arising

**Used For :** 3140 (map 3)

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## Conservation Objectives for : Lough Rea SAC [000304]

### 3140 Hard oligo-mesotrophic waters with benthic vegetation of *Chara* spp.

To maintain the favourable conservation condition of Hard oligo-mesotrophic waters with benthic vegetation of *Chara* spp. in Lough Rea 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	Lough Rea is a very important hard water lake (3140), with one of the deepest euphotic zones (10-11m) known in Ireland (Roden and Murphy, 2012). It was in Favourable/Good conservation condition in 2012 and again in 2018 (Roden and Murphy, 2012, 2018). Two measures of extent should be used: 1. the area of the lake itself and; 2. the extent of the vegetation communities/zones that typify the habitat. Further information relating to all attributes is provided in the lake habitats supporting document for the purposes of site-specific conservation objectives and Article 17 reporting (O Connor, 2015). See also Pentecost (2009) for an overview of marl lakes
Habitat distribution	Occurrence	No decline, subject to natural processes	Lake habitat 3140 occurs in Lough Rea in the SAC. See map 3
Typical species	Occurrence	Typical species present, in good condition, and demonstrating typical abundances and distribution	For lists of 3140 typical species (cyanobacteria, algae, higher plants and water beetles), see the Article 17 habitat assessment for lake habitat 3140 (NPWS, 2013) and the lake habitats supporting document (O Connor, 2015). The vegetation of Lough Rea is dominated by charophytes. The following species were recorded in Lough Rea in 2012: Krustenstein, <i>Ophrydium versatile</i> , <i>Chara aculeolata</i> , <i>C. contraria</i> , <i>C. curta</i> , <i>C. rudis</i> , <i>C. tomentosa</i> , <i>C. virgata</i> , <i>Littorella uniflora</i> , <i>Myriophyllum alterniflorum</i> , <i>M. spicatum</i> and <i>Potamogeton pectinatus</i> (Roden and Murphy, 2012). Lockhart (1984) also recorded <i>Chara curta</i> , <i>C. contraria</i> , <i>Myriophyllum spicatum</i> , <i>Potamogeton filiformis</i> , <i>P. pectinatus</i> , <i>P. pusillus</i> and <i>Sparganium minimum</i>
Vegetation composition: characteristic zonation	Occurrence	All characteristic zones should be present, correctly distributed and in good condition	The characteristic zonation of lake habitat 3140, generally, was described in Roden and Murphy (2013). Roden and Murphy (2012) noted Lough Rea "is an excellent example of a marl lake almost completely dominated by charophytes and krustenstein with very little angiosperm cover", and that it closely resembles Lough Owel (see Roden and Murphy, 2013) and has <i>Chara tomentosa</i> . <i>C. contraria</i> is dominant throughout mid and deep water. The <i>C. rudis</i> band is barely present and, surprisingly, no <i>C. denudata</i> was encountered, but the deep <i>C. contraria</i> had ecorticate branches (Roden and Murphy, 2012). Krustenstein is extensive, with very high percentage cover (P. Duddy, pers. comm.)
Vegetation distribution: maximum depth	Metres	Maintain maximum depth of vegetation, subject to natural processes	The maximum depth of vegetation at Lough Rea is one of the deepest yet recorded in Ireland and was 10-11m in 2012 (Roden and Murphy, 2012). No significant change was found in 2018, with euphotic depth greater than 8.5m at a time of low water level (Roden and Murphy, 2018). The target for Lough Rea is no change/10-11m, subject to natural processes

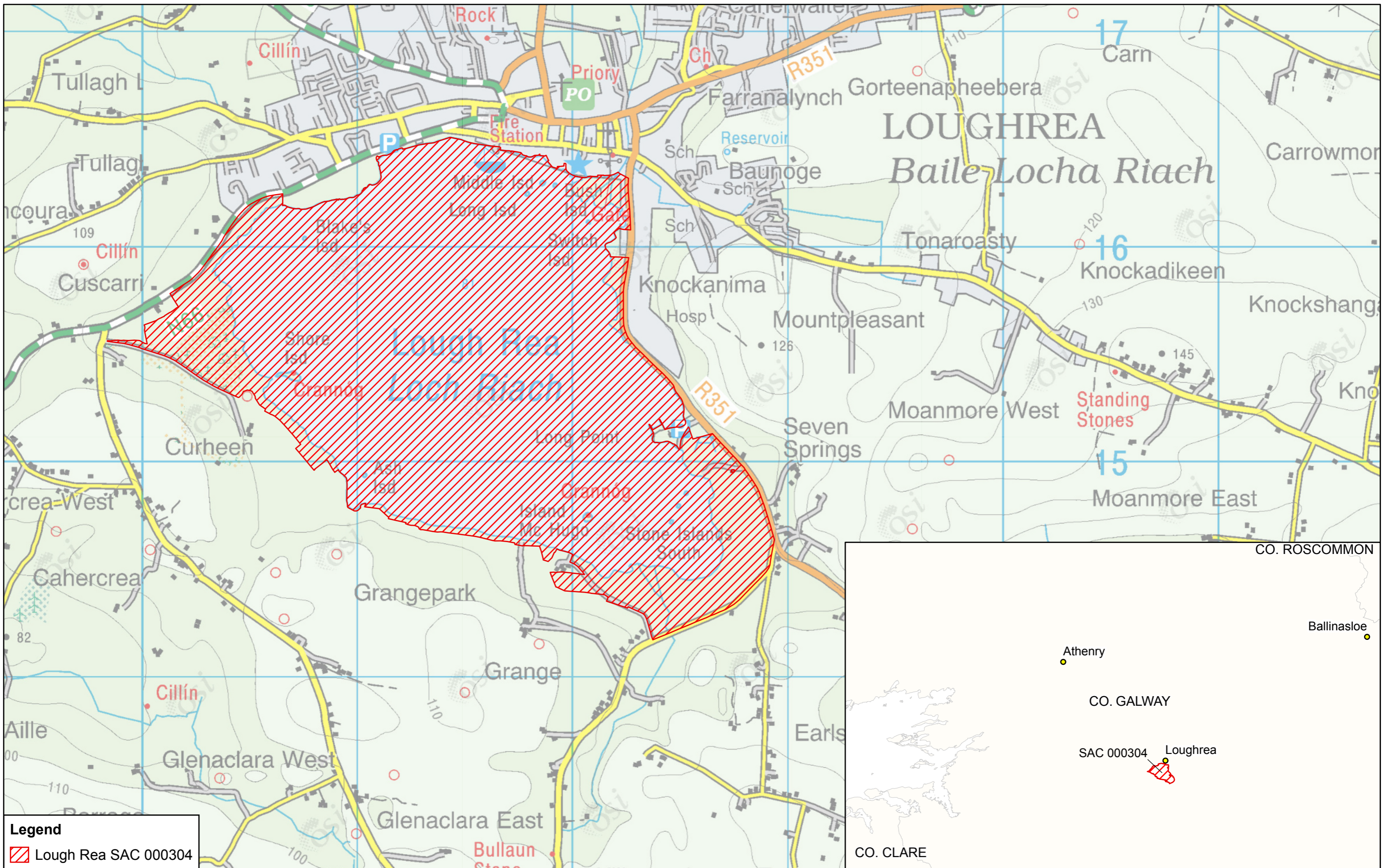


Hydrological regime: water level fluctuations	Metres	Maintain appropriate hydrological regime necessary to support the habitat	Fluctuations in lake water level are typical in Ireland, but can be amplified by activities such as abstraction, drainage and overgrazing. Increased water level fluctuations can increase wave action, up-root vegetation, increase turbidity, alter the substratum and lead to release of nutrients from the sediment. The hydrological regime of lakes with habitat 3140 is driven by groundwater. Water levels in Lough Rea were low in 2018. The hydrological regime must support the maintenance of the habitat's conservation condition, including area, distribution and depth of the lake habitat and its constituent/characteristic vegetation zones and communities
Lake substratum quality	Various	Maintain appropriate substratum type, extent and chemistry to support the vegetation	The hard water lake habitat (3140) is associated with a range of base-rich substratum types, from marl and limestone bedrock, through rocks, cobbles, gravel, muds and even peat. Further research into substratum quality (notably calcium, iron and nutrient concentrations) in the hard water lake habitat would be beneficial
Water quality: transparency	Metres	Maintain appropriate Secchi transparency. There should be no decline in Secchi depth/transparency	Transparency relates to light penetration and, hence, to the depth of colonisation of vegetation. It can be affected by phytoplankton blooms, water colour and turbidity. A target of >6m has been set for hard water lakes (3140) (Roden and Murphy, 2012). The OECD fixed boundary system set transparency targets for oligotrophic lakes of ≥6m annual mean Secchi disk depth and ≥3m annual minimum Secchi disk depth. Hard water lakes typically have high transparency, particularly in the very clear and typical marl forms (Roden and Murphy, 2012). Secchi depth at Lough Rea was 5.2m in 2012 and 4m, in low water levels, in 2018 (Roden and Murphy, 2012, 2018). Free et al. (2006) recorded a Secchi depth of 4.5m (clear to lake bed) in Lough Rea
Water quality: nutrients	µg/l P; mg/l N	Maintain/restore the concentration of nutrients in the water column to sufficiently low levels to support the habitat and its typical species	Lake habitat 3140 is typically associated with high water quality, as demonstrated by naturally low dissolved nutrients. The target for Lough Rea is Water Framework Directive (WFD) High Status or oligotrophic (OECD, 1982). Annual average total phosphorus (TP) concentration should be ≤10µg/l TP, average annual total ammonia concentration should be ≤0.04mg/l N and annual 95th percentile for total ammonia should be ≤0.09mg/l N. Where nutrient concentrations are lower than the targets, there should be no upward trend in concentrations. See also The European Communities Environmental Objectives (Surface Waters) Regulations 2009 and Free et al. (2016). Lough Rea passed the WFD TP target in 2010-12 and 2012-15 (high status), but failed in 2007-09 (good status) (McGarrigle et al., 2010; Bradley et al., 2015; Fanning et al., 2017)
Water quality: phytoplankton biomass	µg/l chlorophyll <i>a</i>	Maintain appropriate water quality to support the habitat, including high chlorophyll <i>a</i> status	Lake habitat 3140 is associated with high water quality, as demonstrated by naturally low algal growth. As for nutrients, the default target is WFD High Status or oligotrophic (OECD, 1982). Average growing season (March-October) chlorophyll <i>a</i> concentration must be <5.8µg/l. Annual average chlorophyll <i>a</i> concentration should be <2.5µg/l and the annual peak should be <8.0µg/l. Where chlorophyll <i>a</i> concentrations are lower than the targets, there should be no upward trend in phytoplankton biomass. See also The European Communities Environmental Objectives (Surface Waters) Regulations 2009. Lough Rea passed the target, having high chlorophyll <i>a</i> status in 2007-09, 2010-12 and 2013-15 (McGarrigle et al., 2010; Bradley et al., 2015; Fanning et al., 2017)


Water quality: phytoplankton composition	EPA phytoplankton composition metric	Maintain appropriate water quality to support the habitat, including high phytoplankton composition status	The Environmental Protection Agency (EPA) has developed a phytoplankton composition metric for nutrient enrichment of Irish lakes. As for other water quality indicators, Lough Rea requires WFD high status. Lough Rea passed the target in 2007-09 and 2012-15 (high status), but failed in 2010-12 (good status) (McGarrigle et al., 2010; Bradley et al., 2015; Fanning et al., 2017)
Water quality: attached algal biomass	Algal cover	Maintain trace/absent attached algal biomass (<5% cover)	Nutrient enrichment can favour epiphytic and epipelagic algae that can out-compete the submerged vegetation. The cover abundance of attached algae in hard water lakes (3140) should, therefore, be trace/absent (<5% cover)
Water quality: macrophyte status	EPA macrophyte metric (The Free Index)	Maintain high macrophyte status	Nutrient enrichment can favour more competitive submerged macrophyte species that out-compete the typical and characteristic species for hard water lakes (3140). The EPA monitors macrophyte status for WFD purposes using the 'Free Index'. The target for lake habitat 3140 is high status or an Ecological Quality Ratio (EQR) for lake macrophytes of $\geq 0.90$ , as defined in Schedule Five of the European Communities Environmental Objectives (Surface Waters) Regulations 2009. Lough Rea passed the target having high macrophyte status since 2007 (McGarrigle et al., 2010; Bradley et al., 2015; Fanning et al., 2017)
Acidification status	pH units; mg/l	Maintain appropriate water and sediment pH, alkalinity and cation concentrations to support the habitat, subject to natural processes	The specific requirements of lake habitat 3140, in terms of water and sediment pH, alkalinity and cation concentration, have not been fully determined. Acidification is not considered a threat to habitat 3140; however, eutrophication can lead to at least temporary increases in pH to toxic levels ( $>9/9.5$ pH units). Maximum pH should be $<9.0$ pH units, in line with the surface water standards. See Schedule Five of the European Communities Environmental Objectives (Surface Waters) Regulations 2009
Water colour	mg/l PtCo	Maintain appropriate water colour to support the habitat	Increased colour decreases light penetration and reduces the area of macrophyte habitat, particularly at the lower euphotic depths. Higher colour also appears to favour angiosperms over charophytes in hard water lakes (Roden and Murphy, 2012). The primary source of increased colour in Ireland is peatland disturbance. No habitat-specific or national standards for water colour exist. Studies have shown median colour concentrations in Irish lakes of 38mg/l PtCo (Free et al., 2000) and 33mg/l PtCo (Free et al., 2006). Habitat 3140 is typically associated with very clear waters and expected colour would be $<10$ mg/l or, more likely, $<5$ mg/l PtCo. Free et al. (2006) reported colour of 3mg/l PtCo in Lough Rea
Dissolved organic carbon (DOC)	mg/l	Maintain appropriate organic carbon levels to support the habitat	Dissolved (and particulate) organic carbon (OC) in the water column is linked to water colour and acidification (organic acids). Increasing DOC in water has been documented across the Northern Hemisphere, including afforested peatland catchments in Ireland. Damage and degradation of peatland, leading to decomposition of peat is likely to be the predominant source of OC in Ireland. OC in water promotes decomposition by fungi and bacteria that, in turn, releases dissolved nutrients. The increased biomass of decomposers can also impact directly on the characteristic lake communities through shading, competition, etc.

Turbidity	Nephelometric turbidity units/ mg/l SS/ other appropriate unit	Maintain appropriate turbidity to support the habitat	Turbidity can significantly affect the quantity and quality of light reaching rooted and attached vegetation and can, therefore, impact on lake habitats. The settlement of higher loads of inorganic or organic material on lake vegetation communities may also have impacts on sensitive, delicate species. Turbidity can increase as a result of re-suspension of material within the lake, higher loads entering the lake, or eutrophication. Turbidity measurement and interpretation is challenging. As a result, it is likely to be difficult to set habitat-specific targets for turbidity in lakes
Fringing habitat: area and condition	Hectares	Maintain the area and condition of fringing habitats necessary to support the natural structure and functioning of lake habitat 3140	Most lake shorelines have fringing habitats that intergrade with and support the structure and functions of the lake habitat. Equally, fringing habitats are dependent on the lake, particularly its water levels, and support wetland communities and species of conservation concern. Many of the fringing wetland habitats support higher invertebrate and plant species richness than the lake habitats themselves. See Mainstone et al. (2016). The shoreline of Lough Rea is relatively simple, with a short transition between open water and surrounding grassland, with reedbed, freshwater marsh and wet grassland in between, as well as some more extensive areas of fen, particularly in the south-west, and some wet woodland





**Legend**

 Lough Rea SAC 000304



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**MAP 1:  
LOUGH REA SAC  
CONSERVATION OBJECTIVES  
SAC DESIGNATION**

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

**SITE CODE:  
SAC 000304; version 3.01. CO. GALWAY**

0 210 420 630 840 Meters

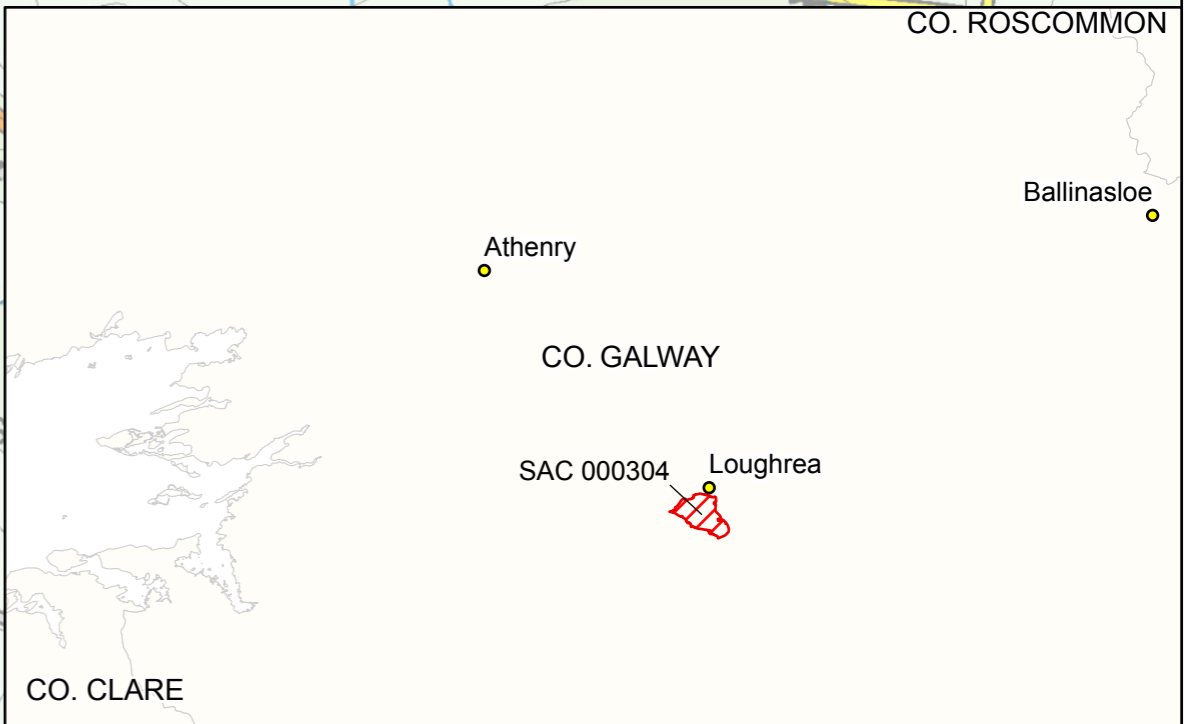
The mapped boundaries are of an indicative and general nature only. Boundaries of designated areas are subject to revision.  
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Níl sna teorainneacha ar na léarscáileanna ach nod garshuíomhach ginearálta. Féadfar athbheithnithe a déanamh ar theorainneacha na gceantar comharthaithe. Suirbhéarachtá Ordonáis na hÉireann Ceadúnas Uimh OSI-NMA-014. © Suirbhéarachtá Ordonáis na hÉireann Rialtas na hÉireann

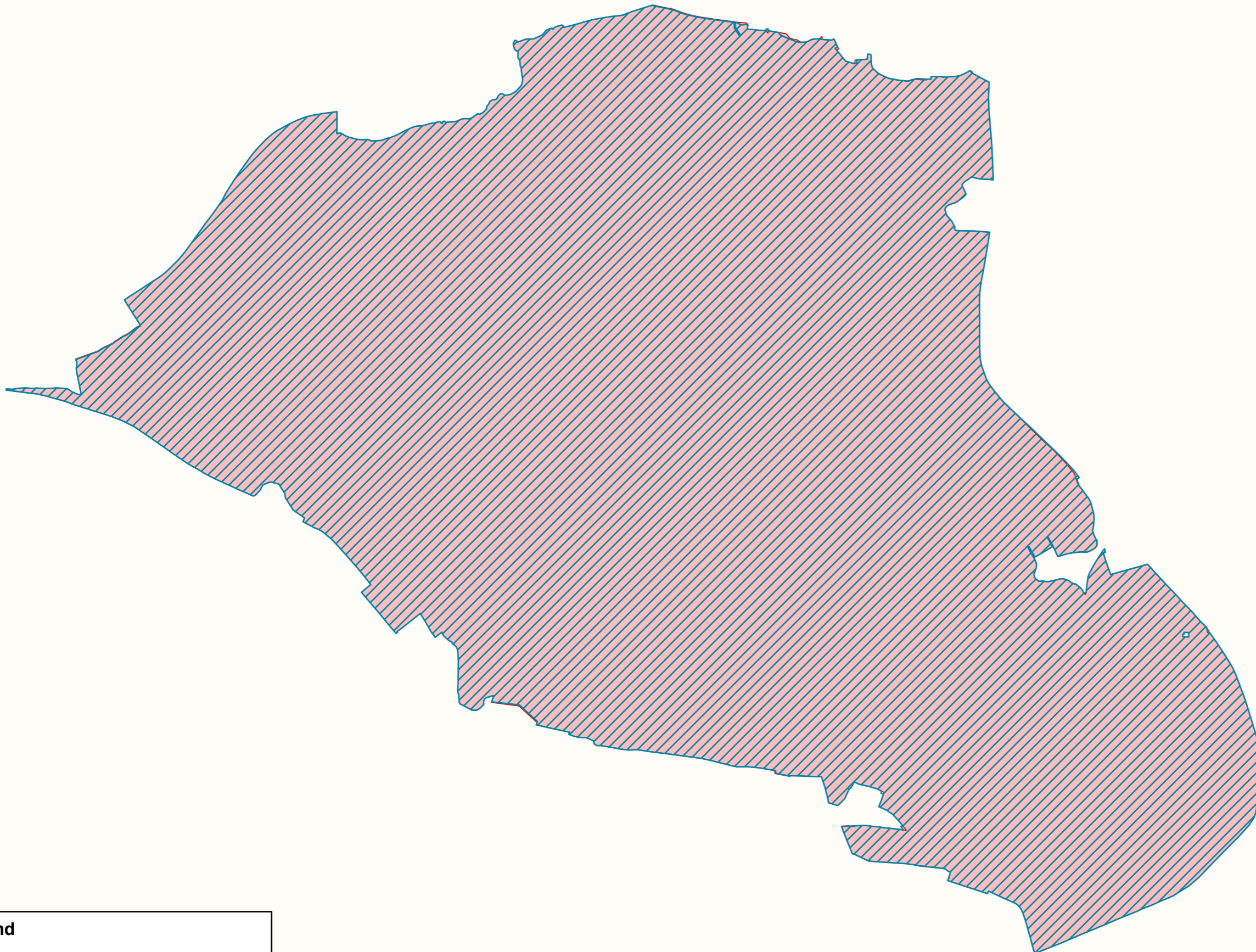
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**Map Version 1  
Date: May 2019**







**Legend**

- Lough Rea SAC 000304
- Lough Rea SPA 004134
- OSi Discovery Series County Boundary

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**MAP 2:  
LOUGH REA SAC  
CONSERVATION OBJECTIVES  
ADJACENT, ADJOINING AND  
OVERLAPPING DESIGNATIONS**

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

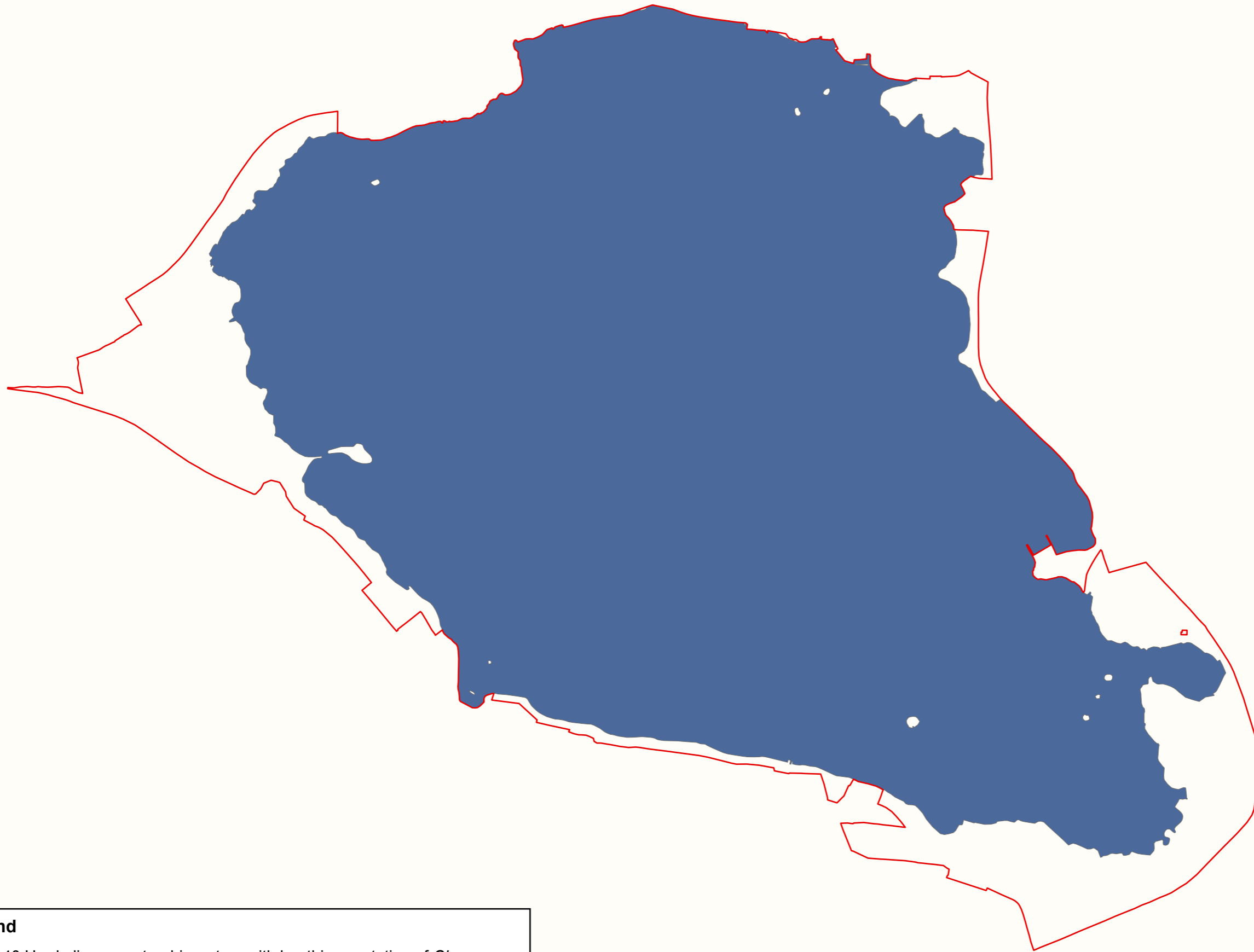
**SITE CODE:  
SAC 000304; version 3.01. CO. GALWAY**

0    130    260    390    520 Meters

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**Map Version 1  
Date: May 2019**



**Legend**

- 3140 Hard oligo-mesotrophic waters with benthic vegetation of *Chara* spp.
- Lough Rea SAC 000304
- OSi Discovery Series County Boundary

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**MAP 3:  
LOUGH REA SAC  
CONSERVATION OBJECTIVES  
INDICATIVE LAKE HABITATS**

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

**SITE CODE:  
SAC 000304; version 3.01. CO. GALWAY**

0    130    260    390    520 Meters

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 garshuíomhach ginearálta. Féadfar athbheithnithe a déanamh ar theorainneacha na gceantar comharthaithe. Suirbhéarachta Ordonáis na hÉireann Ceadúnas Uimh OSI-NMA-014. © Suirbhéarachta Ordonáis na hÉireann Rialtas na hÉireann

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