

National Parks and Wildlife Service

Conservation Objectives Series

River Shannon Callows SAC 000216



An Roinn Tithíochta,
Rialtais Áitiúil agus Oidhreachta
Department of Housing,
Local Government and Heritage

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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

000216	River Shannon Callows SAC
1355	Otter <i>Lutra lutra</i>
6410	<i>Molinia</i> meadows on calcareous, peaty or clayey-silt-laden soils (Molinion caeruleae)
6510	Lowland hay meadows (<i>Alopecurus pratensis</i> , <i>Sanguisorba officinalis</i>)
7230	Alkaline fens
8240	Limestone pavements*
91E0	Alluvial forests with <i>Alnus glutinosa</i> and <i>Fraxinus excelsior</i> (Alno-Padion, Alnion incanae, Salicion albae)*

Please note that this SAC overlaps with Middle Shannon Callows SPA (004096) and is adjacent to Pilgrim's Road Esker SAC (001776), Lough Derg, North-East Shore SAC (002241), Redwood Bog SAC (002353), Lough Derg (Shannon) SPA (004058), River Little Brosna Callows SPA (004086) and River Suck Callows SPA (004097). 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

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

NPWS Documents

Year :	1972
Title :	A Preliminary Report on Areas of Scientific Interest in County Offaly
Author :	Farrell, L.
Series :	Unpublished report
Year :	1999
Title :	SAC Survey of the River Shannon Callows
Author :	Heery, S.; Keane, S.
Series :	Unpublished report to NPWS
Year :	2006
Title :	Otter survey of Ireland 2004/2005
Author :	Bailey, M.; Rochford, J.
Series :	Irish Wildlife Manuals, No. 23
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 :	2009
Title :	Ireland Red List No. 2: Non-marine molluscs
Author :	Byrne, A.; Moorkens, E.A.; Anderson, R.; Killeen, I.J.; Regan, E.C.
Series :	Ireland Red List series, 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 Manuals, No. 46
Year :	2010
Title :	Ireland Red List No. 4: Butterflies
Author :	Regan, E.C.; Nelson, B.; Aldwell, B.; Bertrand, C.; Bond, K.; Harding, J.; Nash, D.; Nixon, D.; Wilson, C.J.
Series :	Ireland Red List series, NPWS
Year :	2012
Title :	Ireland Red List No. 8: Bryophytes
Author :	Lockhart, N.; Hodgetts, N.; Holyoak, D.
Series :	Ireland Red List series, NPWS
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 Manuals, No. 76

Year :	2013
Title :	Irish semi-natural grasslands survey 2007-2012
Author :	O'Neill, F.H.; Martin, J.R.; Devaney, F.M.; Perrin, P.M.
Series :	Irish Wildlife Manuals, No. 78
Year :	2013
Title :	National survey of limestone pavement and associated habitats in Ireland
Author :	Wilson, S.; Fernandez, F.
Series :	Irish Wildlife Manuals, No. 73
Year :	2013
Title :	Results of a monitoring survey of old sessile oak woods and alluvial forests
Author :	O'Neill, F.H.; Barron, S.J.
Series :	Irish Wildlife Manuals, No. 71
Year :	2016
Title :	Ireland Red List No. 10: Vascular Plants
Author :	Wyse Jackson, M.; FitzPatrick, Ú.; Cole, E.; Jebb, M.; McFerran, D.; Sheehy Skeffington, M.; Wright, M.
Series :	Ireland Red Lists series, NPWS
Year :	2018
Title :	The monitoring and assessment of three EU Habitats Directive Annex I grassland habitats
Author :	Martin, J.R.; O'Neill, F.H.; Daly, O.H.
Series :	Irish Wildlife Manuals, No. 102
Year :	2019
Title :	Checklists Protected and Threatened Species in Ireland 2019
Author :	Nelson, B.; Cummins, S.; Fay, L.; Jeffrey, R.; Kelly, S.; Kingston, N.; Lockhart, N.; Marnell, F.; Tierney, D.; Wyse Jackson, M.
Series :	Irish Wildlife Manuals, No. 116
Year :	2021
Title :	Checklists Protected and Threatened Species in Ireland. Version 2.1. 3 December 2021
Author :	Nelson, B.; Cummins, S.; Fay, L.; Jeffrey, R.; Kelly, S.; Kingston, N.; Lockhart, N.; Marnell, F.; Tierney, D.; Wyse Jackson, M.
Series :	Irish Wildlife Manuals, No. 116
Year :	in prep.
Title :	The monitoring and assessment of four EU Habitats Directive Annex I woodland habitats
Author :	Daly, O.H.; O'Neill, F.H.; Barron, S.J.
Series :	Irish Wildlife Manuals
Year :	in prep.
Title :	Scoping study and pilot survey of fens
Author :	O'Neill, F.H.; Perrin, P.M.; Denyer, J.; Martin, J.R.; Daly, O.H.; Brophy, J.T.
Series :	Irish Wildlife Manuals
Year :	in prep.
Title :	Floodplain and callows grasslands in Ireland
Author :	Martin, J.R.; O'Neill, F.H.; Daly, O.H.
Series :	Irish Wildlife Manuals
Year :	in prep.
Title :	Agricultural Atmospheric Ammonia: Identification & Assessment of Potential Impacts
Author :	Kelleghan, D.B.; Fogarty, M.; Welchman, S.; Cummins, T.; Curran, T.P.
Series :	Irish Wildlife Manuals

Other References

Year :	1982
Title :	Otter survey of Ireland
Author :	Chapman, P.J.; Chapman, L.L.
Series :	Unpublished report to Vincent Wildlife Trust
Year :	1991
Title :	The spatial organization of otters (<i>Lutra lutra</i>) in Shetland
Author :	Kruuk, H.; Moorhouse, A.
Series :	Journal of Zoology, 224: 41-57
Year :	2002
Title :	Reversing the habitat fragmentation of British woodlands
Author :	Peterken, G.
Series :	WWF-UK, London
Year :	2006
Title :	Otters - ecology, behaviour and conservation
Author :	Kruuk, H.
Series :	Oxford University Press
Year :	2010
Title :	Otter tracking study of Roaringwater Bay
Author :	De Jongh, A.; O'Neill, L.
Series :	Unpublished draft report to NPWS
Year :	2011
Title :	Review and revision of empirical critical loads and dose-response relationships. Proceedings of an expert workshop, Noordwijkerhout, 23-25 June 2010
Author :	Bobbink, R.; Hettelingh, J.P.
Series :	RIVM report 680359002, Coordination Centre for Effects, National Institute for Public Health and the Environment (RIVM)
Year :	2011
Title :	The Fen Management Handbook
Author :	McBride, A.; Diack, I.; Droy, N.; Hamill, B.; Jones, P.; Schutten, J.; Skinner, A.; Street, M. (eds.)
Series :	Scottish Natural Heritage, Perth
Year :	2012
Title :	Proposed pumphouses at Meelick and Portumna
Author :	Heery, S.; Mayes, E.
Series :	Natura Impact Statement prepared for ESBI
Year :	2016
Title :	Irish Vegetation Classification: Technical Progress Report No. 2
Author :	Perrin, P.
Series :	Report submitted to National Biodiversity Data Centre
Year :	2017
Title :	An ecological report on the habitats, mammals, and birds of Maddens Island, River Shannon, Co. Offaly
Author :	Martin, J.R.; Brophy, J.T.
Series :	Unpublished Report by BEC Consultants Ltd. to Waterways Ireland

Year : 2018
Title : Irish Vegetation Classification: Technical Progress Report No. 4
Author : Perrin, P.
Series : Report submitted to National Biodiversity Data Centre

Spatial data sources

Year :	1999
Title :	Heery and Keane (1999) SAC Survey of the River Shannon Callows
GIS Operations :	Dataset clipped to the SAC boundary. Expert opinion used as necessary to resolve any issues arising
Used For :	6410, 6510 (map 3)
<hr/>	
Year :	2013
Title :	Irish Semi-Natural Grassland Survey
GIS Operations :	Dataset clipped to the SAC boundary. Expert opinion used as necessary to resolve any issues arising
Used For :	6410, 6510 (map 3)
<hr/>	
Year :	2018
Title :	Grasslands Monitoring Survey 2015-2017
GIS Operations :	Dataset clipped to the SAC boundary. Expert opinion used as necessary to resolve any issues arising
Used For :	6410, 6510 (map 3)
<hr/>	
Year :	2021
Title :	Floodplain and Callows Grasslands in Ireland
GIS Operations :	Dataset clipped to the SAC boundary. Expert opinion used as necessary to resolve any issues arising
Used For :	6410, 6510 (map 3)
<hr/>	
Year :	2017
Title :	Martin and Brophy (2017) An ecological report on the habitats, mammals, and birds of Maddens Island, River Shannon, Co. Offaly
GIS Operations :	QIs selected. Dataset clipped to the SAC boundary. Expert opinion used as necessary to resolve any issues arising
Used For :	6510, 91E0 (map 3, 6)
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Year :	2012
Title :	Heery and Mayes (2012) Proposed pumphouses at Meelick and Portumna NIS
GIS Operations :	QI selected. Dataset clipped to the SAC boundary. Expert opinion used as necessary to resolve any issues arising
Used For :	7230 (map 4)
<hr/>	
Year :	2013
Title :	National Survey of Limestone Pavement and Associated Habitats in Ireland distribution data
GIS Operations :	Dataset clipped to the SAC boundary. Expert opinion used as necessary to resolve any issues arising
Used For :	8240 (map 5)
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Conservation Objectives for : River Shannon Callows SAC [000216]

6410 *Molinia* meadows on calcareous, peaty or clayey-silt-laden soils (*Molinion caeruleae*)

To restore the favourable conservation condition of *Molinia* meadows on calcareous, peaty or clayey-silt-laden soils (*Molinion caeruleae*) in River Shannon Callows 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	River Shannon Callows SAC encompasses a large area of seasonally flooded, semi-natural, lowland wet grassland habitats, including the habitat <i>Molinia</i> meadows which occurs in association with Lowland hay meadows (Annex I habitat code 6510) and other grassland habitats (NPWS internal files). <i>Molinia</i> meadows were surveyed as part of the Irish Semi-natural Grassland Survey (ISGS; O'Neill et al., 2013) within eight sub-sites (ISGS site codes 107, 108, 109, 110, 113, 2340, 2342, 2344), of which four (107, 109, 110, 113) were monitored by the Grassland Monitoring Survey (GMS; Martin et al., 2018). An area of 6410 habitat was also mapped in sub-site 111 by the GMS. Further areas of <i>Molinia</i> meadows had also been surveyed by Heery and Keane (1999), and new areas were surveyed during the floodplain grassland survey by Martin et al. (in prep.). The total area mapped in the SAC is 116.7ha. It is important to note that further unsurveyed areas may be present within the SAC
Habitat distribution	Occurrence	No decline, subject to natural processes	Distribution based on Heery and Keane (1999), O'Neill et al. (2013), Martin et al. (2018) and Martin et al. (in prep.). See map 3. It should be noted that the habitat's area and distribution in the continuum/mosaic of grassland habitats in River Shannon Callows SAC can depend on such factors as the annual fluctuation of the water levels in the River Shannon and duration of flooding, and also on management practices such as grazing and mowing. The habitat is widely distributed all along this large SAC, and at both sides of the river channel. Note that further unsurveyed areas of the habitat may be present within the SAC
Vegetation composition: positive indicator species	Number at a representative number of 2m x 2m monitoring stops; within 20m surrounding area of monitoring stops	At least 7 positive indicator species present in monitoring stop or, if 5–6 present in stop, additional species within 20m of stop; this includes at least one 'high quality' positive indicator species present in the stop or within 20m of stop	Attribute and target based on O'Neill et al. (2013) and Martin et al. (2018), where the lists of positive indicator species, including high quality positive indicator species, are also presented. These documents should be consulted for further details. Note that purple moor-grass (<i>Molinia caerulea</i>) is a positive indicator species and should be present in at least one monitoring stop, or within 20m of a monitoring stop, for the attribute to pass (Martin et al., 2018). Note that Martin et al. (2018) mention two additional species which may be considered, should stops fail marginally on presence of indicators. See also Heery and Keane (1999) for species recorded in the habitat in the SAC
Vegetation composition: negative indicator species	Percentage cover at a representative number of 2m x 2m monitoring stops	Negative indicator species collectively not more than 20% cover, with cover by an individual species not more than 10%	Attribute and target based on O'Neill et al. (2013) and Martin et al. (2018), where the list of negative indicator species is presented
Vegetation composition: non-native species	Percentage cover at a representative number of 2m x 2m monitoring stops	Cover of non-native species not more than 1%	Attribute and target based on O'Neill et al. (2013) and Martin et al. (2018)
Vegetation composition: moss species	Percentage cover at a representative number of 2m x 2m monitoring stops	Hair mosses (<i>Polytrichum</i> spp.) not more than 25% cover	Attribute and target based on O'Neill et al. (2013) and Martin et al. (2018)

Vegetation composition: woody species and bracken	Percentage cover at a representative number of 2m x 2m monitoring stops	Cover of woody species and bracken (<i>Pteridium aquilinum</i>) not more than 5% cover	Attribute and target based on O'Neill et al. (2013) and Martin et al. (2018)
Vegetation structure: broadleaf herb:grass ratio	Percentage at a representative number of 2m x 2m monitoring stops	Broadleaf herb component of vegetation between 40% and 90%	Attribute and target based on O'Neill et al. (2013) and Martin et al. (2018). Broadleaf herb component of vegetation between 30% and 40% may be allowed to pass on expert judgement (Martin et al., 2018)
Vegetation structure: sward height	Percentage at a representative number of 2m x 2m monitoring stops	At least 30% of sward between 10cm and 80cm tall	Attribute and target based on O'Neill et al. (2013) and Martin et al. (2018)
Vegetation structure: litter	Percentage cover at a representative number of 2m x 2m monitoring stops	Litter cover not more than 25%	Attribute and target based on O'Neill et al. (2013) and Martin et al. (2018). High litter cover, usually a result of abandonment, or infrequent management, has been recorded in places in this SAC, and is detrimental to plant species diversity
Physical structure: bare ground	Percentage cover at a representative number of 2m x 2m monitoring stops	Not more than 10% bare ground	Attribute and target based on O'Neill et al. (2013) and Martin et al. (2018)
Physical structure: grazing or disturbance	Area in local vicinity of a representative number of monitoring stops	Area of the habitat showing signs of serious grazing or disturbance less than 20m ²	Attribute and target based on O'Neill et al. (2013) and Martin et al. (2018)

Conservation Objectives for : River Shannon Callows SAC [000216]

6510 Lowland hay meadows (*Alopecurus pratensis*, *Sanguisorba officinalis*)

To restore the favourable conservation condition of Lowland hay meadows (*Alopecurus pratensis*, *Sanguisorba officinalis*) in River Shannon Callows 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	This SAC encompasses a large area of seasonally flooded, semi-natural, lowland grassland habitats, including Lowland hay meadows (6510) which can occur in association with <i>Molinia</i> meadows (6410) and other grassland habitats (NPWS internal files). 6510 was surveyed as part of the Irish Semi-natural Grassland Survey (ISGS; O'Neill et al., 2013) at 5 sub-sites, Clonmacnoise (ISGS site code 107), Leitira Callow (108), Moystown Demesne and Bullock Island (109), Long Island (111) and Cappaleitrim (114), of which 3 (109, 111 and 114) were monitored by the Grassland Monitoring Survey (GMS; Martin et al., 2018). An area of 6510 was also mapped in the sub-site Clooncraft (110) by the GMS. Further areas of 6510 were surveyed by Heery and Keane (1999), Martin and Brophy (2017), and new areas were surveyed in the floodplain grassland survey by Martin et al. (in prep.). The total area mapped in the SAC is 38.7ha. It is important to note that further unsurveyed areas may be present in the SAC
Habitat distribution	Occurrence	No decline, subject to natural processes	The distribution of the habitat in River Shannon Callows SAC is based on Heery and Keane (1999), O'Neill et al. (2013), Martin and Brophy (2017), Martin et al. (2018) and Martin et al. (in prep.). See map 3. It is important to note that further unsurveyed areas may be present within the SAC
Vegetation composition: positive indicator species	Number at a representative number of 2m x 2m monitoring stops; within 20m surrounding area of monitoring stops	At least 7 positive indicator species present in monitoring stop or, if 5–6 present in stop, additional species within 20m of stop; this includes at least one 'high quality' positive indicator species present in stop or within 20m of stop	Attribute and target based on O'Neill et al. (2013) and Martin et al. (2018), where the lists of positive indicator species, including high quality positive indicator species, are also presented. These documents should be consulted for further details. See also Heery and Keane (1999) for species recorded in the habitat in the SAC. Of particular note, the Flora (Protection) Order, 2015 listed species meadow barley (<i>Hordeum secalinum</i>) was recorded by the ISGS in Moystown Demesne and Bullock Island (site code 109) in the SAC by O'Neill et al. (2013). This species is listed as Vulnerable in Wyse Jackson et al. (2016). Heery and Keane (1999) recorded the Vulnerable green-winged orchid (<i>Anacamptis morio</i>) and the Near Threatened moonwort (<i>Botrychium lunaria</i>) (Wyse Jackson et al., 2016)
Vegetation composition: negative indicator species	Percentage cover at a representative number of 2m x 2m monitoring stops	Negative indicator species collectively not more than 20% cover, with cover by an individual species not more than 10%	Attribute and target based on O'Neill et al. (2013) and Martin et al. (2018), where the list of negative indicator species is also presented. During the GMS (Martin et al., 2018), it was found that an area of 6510 habitat within the sub-site Long Island (site code 111) had been agriculturally improved since the site was surveyed by the ISGS in 2007, with the negative indicator species perennial rye-grass (<i>Lolium perenne</i>) and white clover (<i>Trifolium repens</i>) common in places. Agricultural intensification was also found to have led to the loss of an area of the Annex I 6510 habitat in the sub-site Cappaleitrim (site code 114) (Martin et al., 2018)
Vegetation composition: non-native species	Percentage cover at a representative number of 2m x 2m monitoring stops	Cover of non-native species not more than 1%	Attribute and target based on O'Neill et al. (2013) and Martin et al. (2018)

Vegetation composition: woody species and bracken	Percentage cover at a representative number of 2m x 2m monitoring stops	Cover of woody species and bracken (<i>Pteridium aquilinum</i>) not more than 5%	Attribute and target based on O'Neill et al. (2013) and Martin et al. (2018)
Vegetation structure: broadleaf herb:grass ratio	Percentage at a representative number of 2m x 2m monitoring stops	Broadleaf herb component of vegetation between 40% and 90%	Attribute and target based on O'Neill et al. (2013). A marginal failure result (35-39%) in the percentage broadleaf herb component may be allowed to pass on expert judgement (Martin et al., 2018). The broadleaf herb to grass ratio can be badly affected by agricultural improvement actions, such as fertiliser use, re-seeding, etc., which all favour grass growth over herb growth. This has been found to be an issue at a number of sites in this SAC by Martin et al. (2018)
Vegetation structure: sward height	Percentage at a representative number of 2m x 2m monitoring stops	At least 50% of sward between 10cm and 50cm tall	Attribute and target based on O'Neill et al. (2013) and Martin et al. (2018)
Vegetation structure: litter	Percentage cover at a representative number of 2m x 2m monitoring stops	Litter cover not more than 25%	Attribute and target based on O'Neill et al. (2013) and Martin et al. (2018)
Physical structure: bare soil	Percentage cover at a representative number of 2m x 2m monitoring stops	Not more than 5% bare soil	Attribute and target based on O'Neill et al. (2013) and Martin et al. (2018)
Physical structure: disturbance	Area in local vicinity of a representative number of monitoring stops	Area of the habitat showing signs of serious grazing or other disturbance less than 20m ²	Attribute and target based on O'Neill et al. (2013) and Martin et al. (2018)

To maintain the favourable conservation condition of Alkaline fens in River Shannon Callows 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	Alkaline fen in River Shannon Callows SAC occurs south of Portumna Bridge and south-east of the town of Portumna in an area of low-lying terrestrial land west of the river. The fen area corresponds largely to a former small bay at the northern end of Lough Derg that was cut off from the lake when the embankment was originally constructed as part of the Shannon Hydroelectric Scheme in the late 1920s. The area of alkaline fen in the SAC has been mapped as c.15ha based on Heery and Mayes (2012). See map 4. It is important to note that further unsurveyed areas of the habitat may be present within the SAC
Habitat distribution	Occurrence	No decline, subject to natural processes	Distribution based on Heery and Mayes (2012). See map 4. It is important to note that further unsurveyed areas of the habitat may be present within the SAC
Ecosystem function: soil nutrients	Soil pH and appropriate nutrient levels at a representative number of monitoring stops	Maintain soil pH and nutrient status within natural ranges	Relevant nutrients and their natural ranges are yet to be defined. However, nitrogen deposition is noted as being relevant to this habitat in O'Neill et al. (in prep.). See also Kelleghan et al. (in prep.) and Bobbink and Hettelingh (2011). Increased nutrients can lead to changes in plant and invertebrate species through competition and subsequent structural changes to micro-habitats. These nutrients favour growth of grasses rather than forbs and mosses and leads to a higher and denser sward
Ecosystem function: peat formation	Percentage cover of peat-forming vegetation and water table levels	Maintain 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
Ecosystem function: hydrology - groundwater levels	Water levels (centimetres); duration of levels; hydraulic gradients; water supply levels	Maintain, or restore where necessary, appropriate natural hydrological regimes necessary to support the natural structure and functioning of the habitat	Fen habitats require high groundwater levels (i.e. water levels at or above the ground surface) for a large proportion of the calendar year (i.e. duration of mean groundwater level). Fen groundwater levels are controlled by regional groundwater levels in the contributing catchment area (which sustain the hydraulic gradients of the fen groundwater table). Regional abstraction of groundwater may affect fen groundwater levels. In this SAC, the fen may partly be fed by springs, and there is some evidence of base-rich flushing on sloping ground with outcropping rock to the west of the fen (Heery and Mayes, 2012)
Ecosystem function: hydrology - surface water flow	Drain density and form	Maintain, or restore where necessary, as close as possible to natural or semi-natural drainage conditions	Drainage, either within or surrounding the fen habitat, can result in the drawdown of the groundwater table. The depth, geometry and density of drainage (hydromorphology) will indicate the scale and impact on fen hydrology. Drainage can result in loss of characteristic species and transition to drier habitats
Ecosystem function: water quality	Various	Maintain appropriate water quality, particularly pH and nutrient levels, 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 the limiting nutrient under natural conditions. Water supply should also be relatively calcium-rich

Vegetation composition: community diversity	Abundance of variety of vegetation communities	Maintain variety of vegetation communities, subject to natural processes	Heery and Mayes (2012) described two main communities in the habitat in the SAC based on relevé data. The first was <i>Carex lasiocarpa</i> - <i>Menyanthes trifoliata</i> vegetation where <i>C. lasiocarpa</i> , <i>C. acutiformis</i> and <i>M. trifoliata</i> were constant, while <i>C. lasiocarpa</i> was slightly less abundant where <i>Schoenus nigricans</i> was present towards the north of the fen area. <i>Utricularia intermedia</i> was a component of this type and calcium carbonate accretions were common among the mosses. The second type was a <i>Briza media</i> - <i>Carex disticha</i> - <i>Festuca rubra</i> community which was rich in small sedges, and also orchid-rich. <i>Cirsium dissectum</i> , while widespread over the whole fen, was commonest in this community. Information on the vegetation communities associated with alkaline fens is provided by O'Neill et al. (in prep.). See also the Irish Vegetation Classification (Perrin, 2018; www.biodiversityireland.ie/projects/ivc-classification-explorer)
Vegetation composition: typical brown mosses	Percentage cover at a representative number of monitoring stops	Maintain adequate cover of typical brown moss species	For lists of typical bryophyte species, including high quality indicator species, see O'Neill et al. (in prep.). Typical brown moss species recorded in the habitat in the SAC by Heery and Mayes (2012) include <i>Bryum pseudotriquetrum</i> , <i>Campylium stellatum</i> , <i>Scorpidium cossonii</i> and <i>S. scorpioides</i>
Vegetation composition: typical vascular plants	Percentage cover at a representative number of monitoring stops	Maintain adequate cover of typical vascular plant species	For lists of typical vascular plant species for the different vegetation communities, including high quality indicators, see O'Neill et al. (in prep.). Typical species recorded in the habitat in the SAC by Heery and Mayes (2012) include slender sedge (<i>Carex lasiocarpa</i>), carnation sedge (<i>Carex panicea</i>), few-flowered spike-rush (<i>Eleocharis quinqueflora</i>), purple moor-grass (<i>Molinia caerulea</i>) and meadow thistle (<i>Cirsium dissectum</i>). The high quality indicator species early marsh-orchid (<i>Dactylorhiza incarnata</i>) and marsh helleborine (<i>Epipactis palustris</i>) have been recorded within the fen in the SAC (Heery and Mayes, 2012)
Vegetation composition: native negative indicator species	Percentage cover at a representative number of monitoring stops	Cover of native negative indicator species at insignificant levels	Negative indicators include species not characteristic of the habitat and species indicative of undesirable activities such as overgrazing, undergrazing, nutrient enrichment, agricultural improvement or impacts on hydrology. Native negative indicators may include <i>Anthoxanthum odoratum</i> , <i>Epilobium hirsutum</i> , <i>Holcus lanatus</i> , <i>Juncus effusus</i> , <i>Phragmites australis</i> and <i>Ranunculus repens</i> . See O'Neill et al. (in prep.). <i>Phragmites australis</i> and <i>Ranunculus repens</i> were recorded in a number of relevés collected by Heery and Mayes (2012), but at relatively low cover
Vegetation composition: non-native species	Percentage cover at a representative number of monitoring stops	Cover of non-native species less than 1%	Attribute and target based on O'Neill et al. (in prep.). Non-native species can be invasive and have deleterious effects on native vegetation. A low target is set as non-native species can spread rapidly and are most easily dealt with when still at lower abundances
Vegetation composition: native trees and shrubs	Percentage cover in local vicinity of a representative number of monitoring stops	Cover of scattered native trees and shrubs less than 10%	Attribute and target based on O'Neill et al. (in prep.). Scrub and trees will tend to invade if fen conditions become drier
Vegetation composition: algal cover	Percentage cover at, and in local vicinity of, a representative number of monitoring stops	Cover of algae less than 2%	Attribute and target based on O'Neill et al. (in prep.). Algal cover is indicative of nutrient enrichment from multiple sources (McBride et al., 2011)
Vegetation structure: vegetation height	Percentage cover at a representative number of monitoring stops	At least 50% of the live leaves/flowering shoots are more than either 5cm or 15cm above ground surface depending on community type	Attribute and target based on O'Neill et al. (in prep.). While grazing may be appropriate in this habitat, excessive grazing can reduce the ability of plant species to regenerate reproductively and maintain species diversity, especially if flowering shoots are cropped during the growing season

Physical structure: disturbed bare ground	Percentage cover at, and in local vicinity of, a representative number of monitoring stops	Cover of disturbed bare ground not more than 10%	Attribute and target based on O'Neill et al. (in prep.). While grazing may be appropriate in this habitat, excessive areas of disturbed bare ground may develop due to unsuitable grazing regimes. Disturbance can include hoof marks, wallows, human footprints, vehicle and machinery tracks. Excessive disturbance can result in loss of characteristic species and presage erosion for peatlands
Physical structure: tufa formations	Percentage cover in local vicinity of a representative number of monitoring stops	Disturbed proportion of vegetation cover where tufa is present is less than 1%	Attribute and target based on O'Neill et al. (in prep.). Heery and Mayes (2012) recorded tufa formation at the base of brown mosses in areas of the habitat in the SAC
Indicators of local distinctiveness	Occurrence and population size	No decline in distribution or population sizes of rare, threatened or scarce species associated with the habitat; maintain features of local distinctiveness, subject to natural processes	This includes species on the Flora (Protection) Order, 2015 and species of flora and fauna on Red Lists (Byrne et al., 2009; Regan et al., 2010; Lockhart et al., 2012; Wyse Jackson et al., 2016, etc.; see Nelson et al., 2019, 2021). Of note is the presence of marsh pea (<i>Lathyrus palustris</i>) in the habitat in the SAC. This species is extremely scarce in Ireland, with half of its distribution occurring along the River Shannon (Heery and Mayes, 2012)
Transitional areas between fen and adjacent habitats	Hectares; distribution	Maintain adequate transitional areas to support/protect the alkaline fen habitat and the services it provides	In many cases, fens transition to other wetland habitats. It is important that the transitional areas between fens and other habitats are maintained in as natural condition as possible in order to protect the functioning of the fen. Alkaline fen represents about a third of the terrestrial land that is within the part of the SAC south of Portumna Bridge and west of the river. The rest of this terrestrial area is unimproved/semi-improved grassland and there is c.2ha of reedswamp vegetation within the fen itself (Heery and Mayes, 2012)

Conservation Objectives for : River Shannon Callows SAC [000216]

8240 Limestone pavements*

To maintain the favourable conservation condition of Limestone pavements* in River Shannon Callows 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	Limestone pavements* in River Shannon Callows SAC occurs at Clorhane, which represents the only area of limestone pavement in Co. Offaly and one of relatively few located east of the Shannon. The limestone pavement is predominantly wooded with mature hazel (<i>Corylus avellana</i>), interspersed with some exposed pavement and calcareous grassland and scrub (NPWS internal files). Wilson and Fernandez (2013) mapped the indicative area of limestone pavement, including mosaics with grassland, scrub and woodland, as 38.7ha (map 5). As part of the National Survey of Native Woodlands (NSNW), part of the hazel wood was surveyed by Perrin et al. (2008) in the sub-site Clorhane Wood (NSNW site code 35)
Distribution	Occurrence	No decline. Map 5 shows the indicative distribution, including mosaics with other habitats	See the notes for habitat area above. Distribution based on Wilson and Fernandez (2013). This habitat can be split into exposed pavement and wooded pavement. In River Shannon Callows SAC, the majority of the habitat present is wooded pavement
Vegetation composition: positive indicator species	Number at a representative number of monitoring stops	At least seven positive indicator species present	Positive indicator species for exposed and wooded pavement are listed in Wilson and Fernandez (2013). Positive indicator species occurring in the open pavement in the SAC include the ferns hart's-tongue (<i>Asplenium scolopendrium</i>), wall-rue (<i>A. ruta-muraria</i>) and maidenhair spleenwort (<i>A. trichomanes</i>). Positive indicator species occurring in the wooded pavement include hazel (<i>Corylus avellana</i>), blackthorn (<i>Prunus spinosa</i>), bramble (<i>Rubus fruticosus</i> agg.), primrose (<i>Primula vulgaris</i>), common dog-violet (<i>Viola riviniana</i>), wood sorrel (<i>Oxalis acetosella</i>), herb-robert (<i>Geranium robertianum</i>) and the mosses <i>Neckera crispa</i> and <i>Hylocomium brevirostre</i> (Farrell, 1972; Perrin et al., 2008; NPWS internal files)
Vegetation composition: bryophyte layer	Percentage at a representative number of monitoring stops	Bryophyte cover at least 50% on wooded pavement	Attribute and target based on Wilson and Fernandez (2013)
Vegetation composition: negative indicator species	Percentage at a representative number of monitoring stops	Collective cover of negative indicator species on exposed pavement not more than 1%	Negative indicator species are listed in Wilson and Fernandez (2013). Negative indicator species for wooded pavement overlap with non-native species (below)
Vegetation composition: non-native species	Percentage at a representative number of monitoring stops	Cover of non-native species not more than 1% on exposed pavement; on wooded pavement not more than 10% with no regeneration	Attribute and target based on Wilson and Fernandez (2013). European larch (<i>Larix decidua</i>), Sitka spruce (<i>Picea sitchensis</i>) and Norway spruce (<i>Picea abies</i>) have been planted sparsely throughout the Clorhane Wood sub-site (NSNW site code 35) (Perrin et al., 2008)
Vegetation composition: scrub	Percentage at a representative number of monitoring stops	Scrub cover no more than 25% of exposed pavement	Attribute and target based on Wilson and Fernandez (2013)
Vegetation composition: bracken cover	Percentage at a representative number of monitoring stops	Bracken (<i>Pteridium aquilinum</i>) cover no more than 10% on exposed pavement	Attribute and target based on Wilson and Fernandez (2013)
Vegetation structure: woodland canopy	Percentage at a representative number of monitoring stops	Canopy cover on wooded pavement at least 30%	Attribute and target based on Wilson and Fernandez (2013)

Vegetation structure: dead wood	Occurrence in a representative number of monitoring stops	Sufficient quantity of dead wood on wooded pavement to provide habitat for saproxylic organisms	Dead wood is a valuable resource and an integral part of a healthy, functioning woodland ecosystem
Physical structure: disturbance	Occurrence in a representative number of monitoring stops	No evidence of grazing pressure on wooded pavement	Attribute and target based on Wilson and Fernandez (2013)
Indicators of local distinctiveness	Occurrence and population size	No decline in distribution or population sizes of rare, threatened or scarce species associated with the habitat; maintain features of local distinctiveness, subject to natural processes	This includes species listed in the Flora (Protection) Order, 2015 and species of flora and fauna on red data lists (Byrne et al., 2009; Regan et al., 2010; Lockhart et al., 2012; Wyse Jackson et al., 2016, etc.; see Nelson et al., 2019, 2021) and other rare or localised species, as well as archaeological and geological features, which often support distinctive species. The Vulnerable green-winged orchid (<i>Anacamptis morio</i>) (Wyse Jackson et al., 2016) has been recorded in open pavement on short grassy turf in the SAC (NPWS internal files)

Conservation Objectives for : River Shannon Callows SAC [000216]

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 Shannon Callows SAC, which is defined by the following list of attributes and targets:

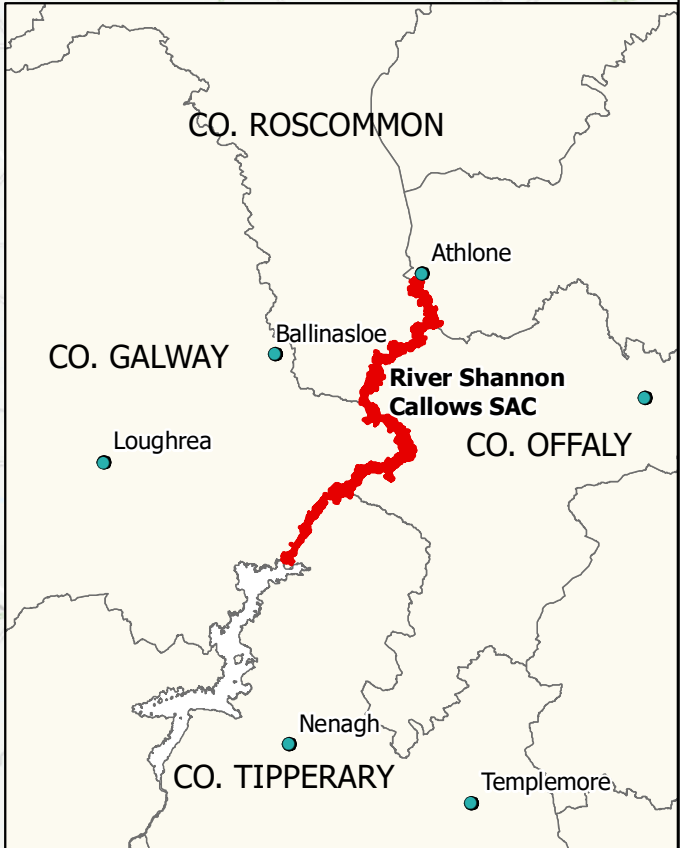
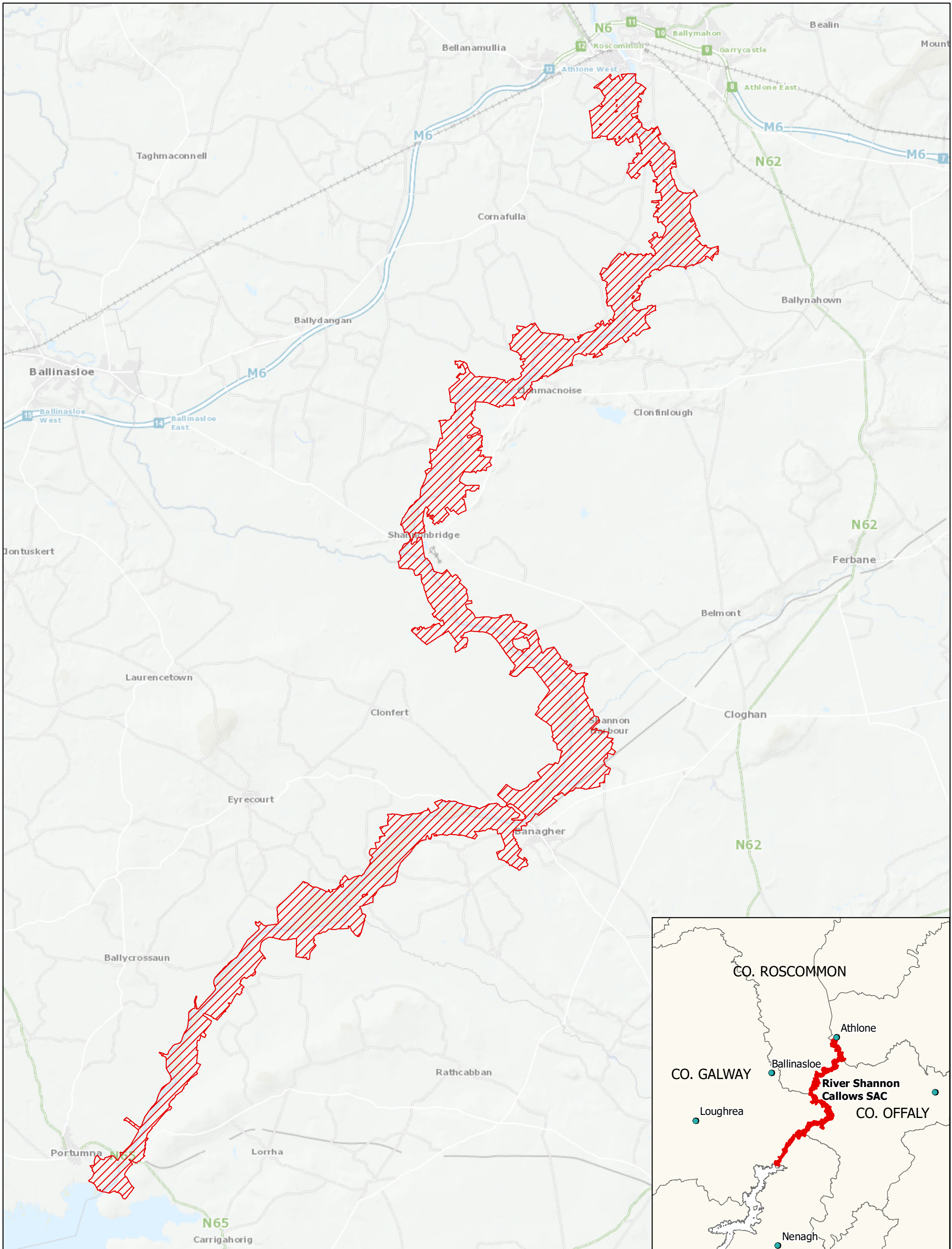
Attribute	Measure	Target	Notes
Habitat area	Hectares	Area stable or increasing, subject to natural processes. See map 6	Alluvial forests with <i>Alnus glutinosa</i> and <i>Fraxinus excelsior</i> (Alno-Padion, Alnion incanae, Salicion albae)* is present in River Shannon Callows SAC. Alluvial woodland has been identified at numerous locations along the Shannon from the islands below the ESB weir at Meelick to Madden's Island upstream. A small area of Alluvial woodland (1.1ha) has been mapped on two river islands at Madden's Island (Martin and Brophy, 2017). However, with the exception of Madden's Island, the habitat has not been mapped in detail and thus the current total habitat area within the SAC is unknown. The habitat is found on riverbanks and alluvial islands which are prone to periodic flooding (NPWS internal files). It is important to note that further areas of the habitat may be present elsewhere within the SAC and other documented areas of wet woodland, e.g. around Bishop's Island, Banagher and Clonburren (NPWS internal files), may also correspond to this priority Annex I woodland type
Habitat distribution	Occurrence	No decline, subject to natural processes. The surveyed woodland area is shown on map 6	Distribution based on Martin and Brophy (2017). See the notes on habitat area above. It is important to note that further unsurveyed areas may be present within the SAC
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 target areas for individual woodlands aim to reduce habitat fragmentation and benefit those species requiring 'deep' woodland conditions (Peterken, 2002). In some cases, topographical constraints may restrict expansion
Woodland structure: cover and height	Percentage; metres; centimetres	Total canopy cover at least 30%; median canopy height at least 7m; native shrub layer cover 10-75%; native herb/dwarf shrub layer cover at least 20% and height at least 20cm; bryophyte cover at least 4%	The target aims for a diverse structure with a canopy containing mature trees, shrub layer with semi-mature trees and shrubs, and well-developed field layer (herbs, graminoids and dwarf shrubs) and ground layer (bryophytes). Assessment criteria are described in Daly et al. (in prep.) and O'Neill and Barron (2013)
Woodland structure: community diversity and extent	Hectares	Maintain diversity and extent of community types	Described in Perrin et al. (2008). See also the Irish Vegetation Classification (Perrin, 2016; www.biodiversityireland.ie/projects/ivc-classificationexplorer)
Woodland structure: natural regeneration	Seedling: sapling: pole ratio	Seedlings, saplings and pole age-classes of target species for 91E0* woodlands and other native tree species occur in adequate proportions to ensure survival of woodland canopy	The target species for 91E0* are alder (<i>Alnus glutinosa</i>), ash (<i>Fraxinus excelsior</i>) and willows (<i>Salix</i> spp.). Assessment criteria are described in Daly et al. (in prep.) and O'Neill and Barron (2013)
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 and lake floodplains, but not for woodland around springs/seepage areas. The riverbanks and alluvial islands where the habitat is known to occur in the SAC are prone to periodic flooding (NPWS internal files)

Woodland structure: dead wood	Number per hectare	At least 19 stems/ha of dead wood at least 20cm diameter	Dead wood is a valuable resource and an integral part of a healthy, functioning woodland ecosystem. Dead wood comprises old senescent trees, standing dead trees, fallen dead wood (including large branches) and rotten stumps of any tree species. Assessment criteria are described in Daly et al. (in prep.) and O'Neill and Barron (2013)
Woodland structure: veteran trees	Number per hectare	No decline	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 distinctiveness	Occurrence; population size	No decline in distribution and, in the case of red listed and other rare or localised species, population size	Includes ancient or long-established woodlands (see Perrin and Daly, 2010), archaeological and geological features as well as red listed and other rare or localised species. Buckthorn (<i>Rhamnus cathartica</i>) is present within Alluvial woodland in the Meelick area, with some individuals being remarkably large (NPWS internal files)
Woodland structure: indicators of overgrazing	Occurrence	All five indicators of overgrazing absent	There are five indicators of overgrazing within 91E0*: topiary effect on shrubs and young trees, browse line on mature trees, abundant dung, severe recent bark stripping, and trampling (Daly et al., in prep.)
Vegetation composition: native tree cover	Percentage	No decline. Native tree cover at least 90% of canopy; target species cover at least 50% of canopy	The target species for 91E0* are alder (<i>Alnus glutinosa</i>), ash (<i>Fraxinus excelsior</i>) and willows (<i>Salix</i> spp.) (Daly et al., in prep.; O'Neill and Barron, 2013)
Vegetation composition: typical species	Occurrence	At least 1 target species for 91E0* woodlands present; at least 6 positive indicator species for 91E0* woodlands present	A variety of typical native species should be present, depending on woodland type. The target species for 91E0* are alder (<i>Alnus glutinosa</i>), ash (<i>Fraxinus excelsior</i>) and willows (<i>Salix</i> spp.). Positive indicator species for 91E0* are listed in Daly et al. (in prep.) and O'Neill and Barron (2013)
Vegetation composition: negative indicator species	Occurrence	Negative indicator species cover not greater than 10%; regeneration of negative indicator species absent	Negative indicator species (i.e. any non-native species, including herbaceous species) should be absent or under control. In general, the following are the most common non-native invasive species in 91E0* woodlands: sycamore (<i>Acer pseudoplatanus</i>), beech (<i>Fagus sylvatica</i>) and horse-chestnut (<i>Aesculus hippocastanum</i>) (Daly et al., in prep.)
Vegetation composition: problematic native species	Percentage	Cover of common nettle (<i>Urtica dioica</i>) less than 75%	Common nettle (<i>Urtica dioica</i>) is a positive indicator species for 91E0* but, in some cases, it may become excessively dominant. Increased light and nutrient enrichment are factors which favour proliferation of common nettle (Daly et al., in prep.)

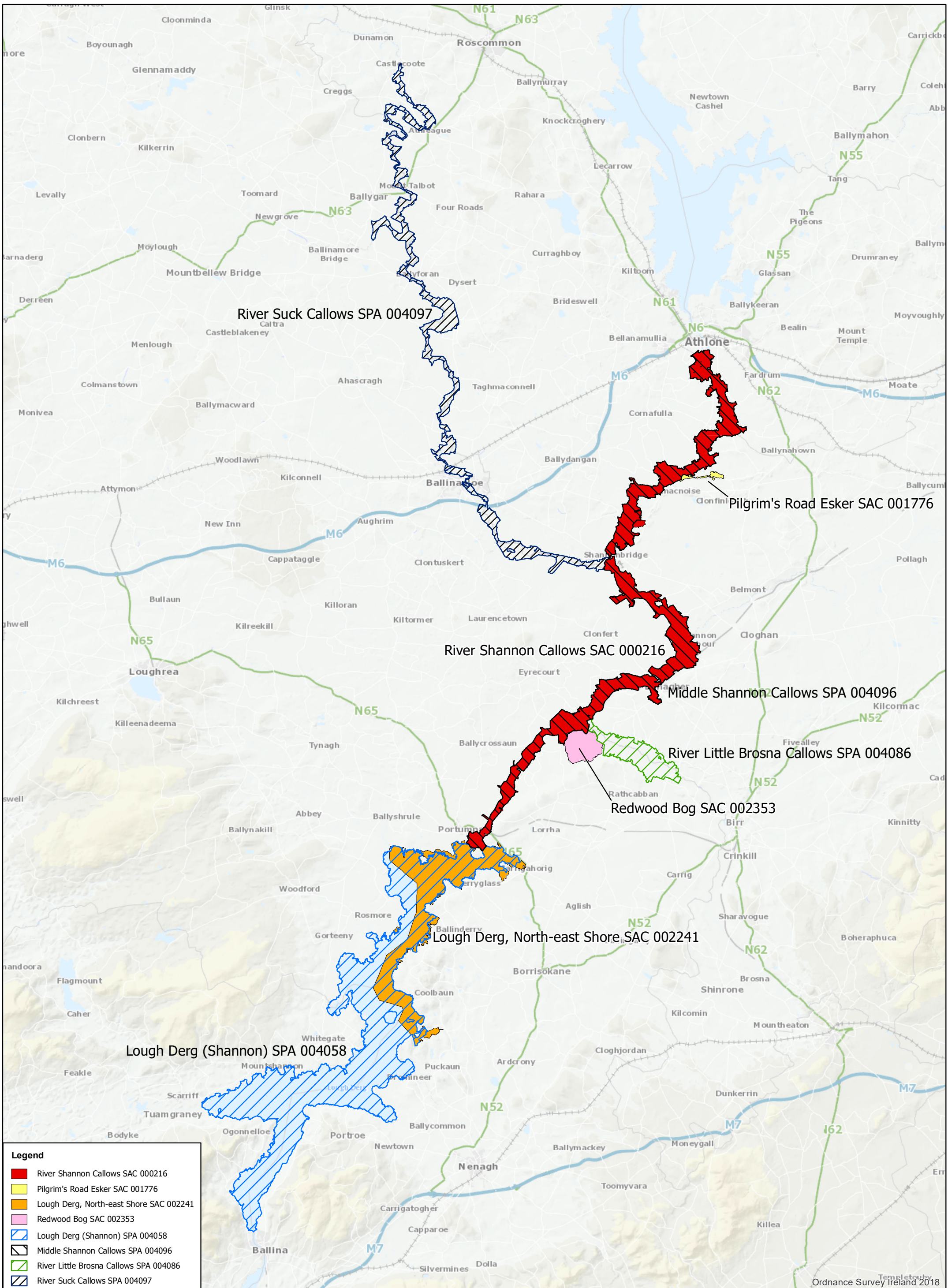
Conservation Objectives for : River Shannon Callows SAC [000216]**1355 Otter *Lutra lutra***

To maintain the favourable conservation condition of Otter (*Lutra lutra*) in River Shannon Callows 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. Favourable Conservation Status (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 282.1ha	No field survey. Areas mapped to include 10m terrestrial buffer along shorelines and river banks identified as critical for otters (NPWS, 2007)
Extent of freshwater (river) habitat	Kilometres	No significant decline. Length mapped and calculated as 146.7km	No field survey. River length calculated on the basis that otters will utilise freshwater habitats from estuary to headwaters (Chapman and Chapman, 1982)
Couching sites and holts	Number	No significant decline	Otters need lying up areas throughout their territory where they are secure from disturbance (Kruuk and Moorhouse, 1991; Kruuk, 2006)
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	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

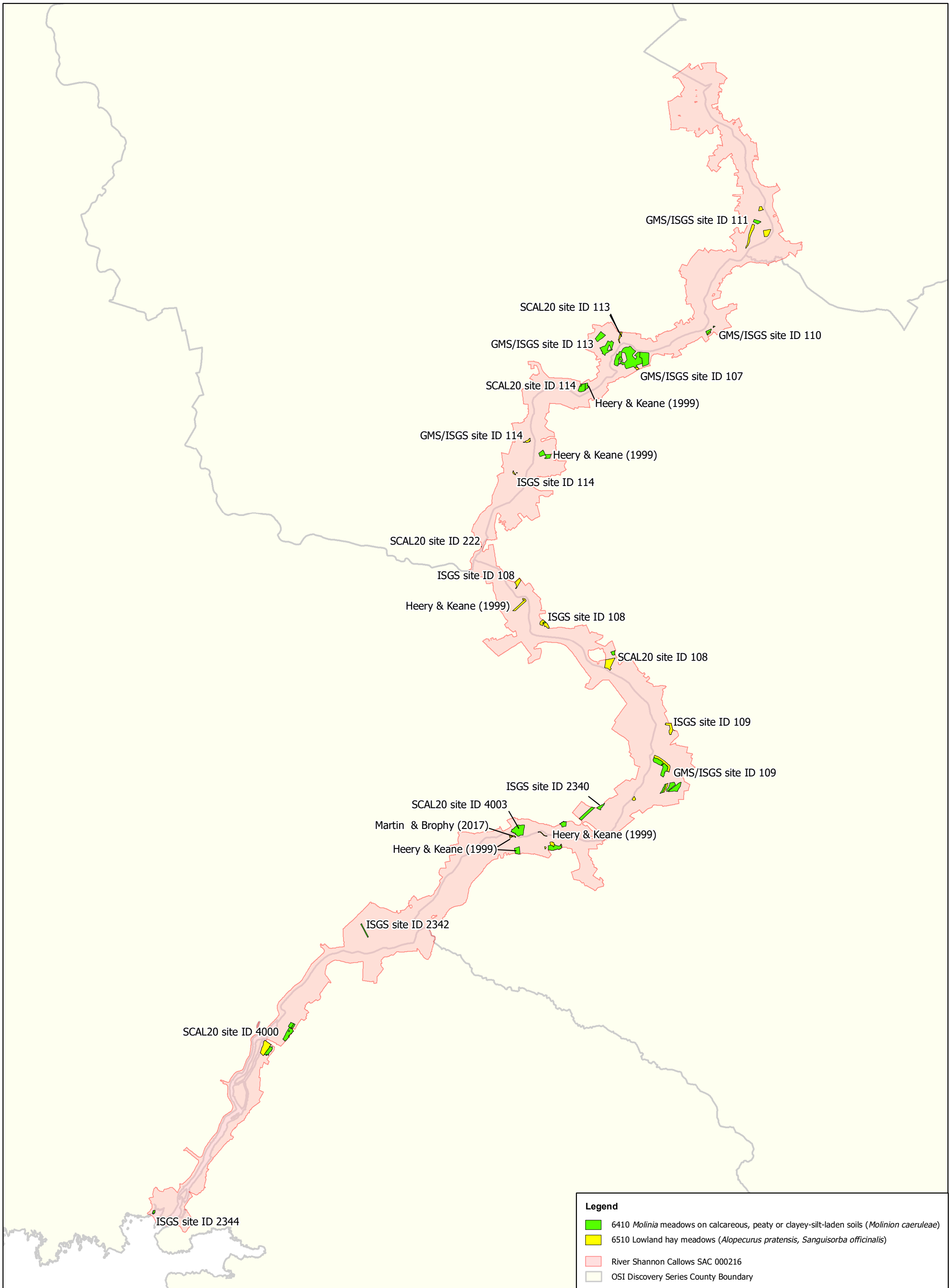


Legend
 River Shannon Callows SAC 000216



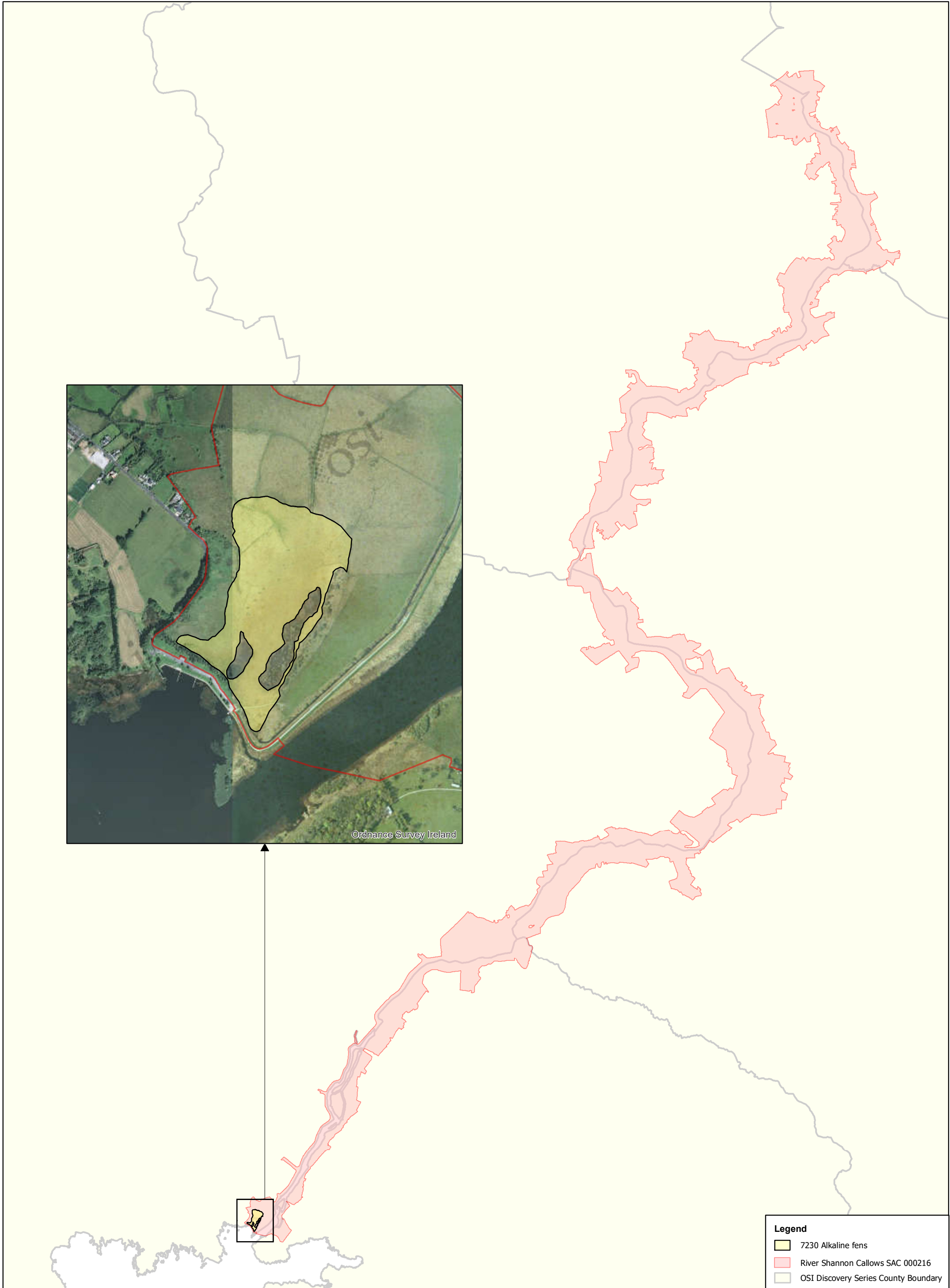
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- River Shannon Callows SAC 000216
- Pilgrim's Road Esker SAC 001776
- Lough Derg, North-east Shore SAC 002241
- Redwood Bog SAC 002353
- Lough Derg (Shannon) SPA 004058
- Middle Shannon Callows SPA 004096
- River Little Brosna Callows SPA 004086
- River Suck Callows SPA 004097



Legend

- 6410 *Molinia* meadows on calcareous, peaty or clayey-silt-laden soils (*Molinia caeruleae*)
- 6510 Lowland hay meadows (*Alopecurus pratensis*, *Sanguisorba officinalis*)
- River Shannon Callows SAC 000216
- OSI Discovery Series County Boundary

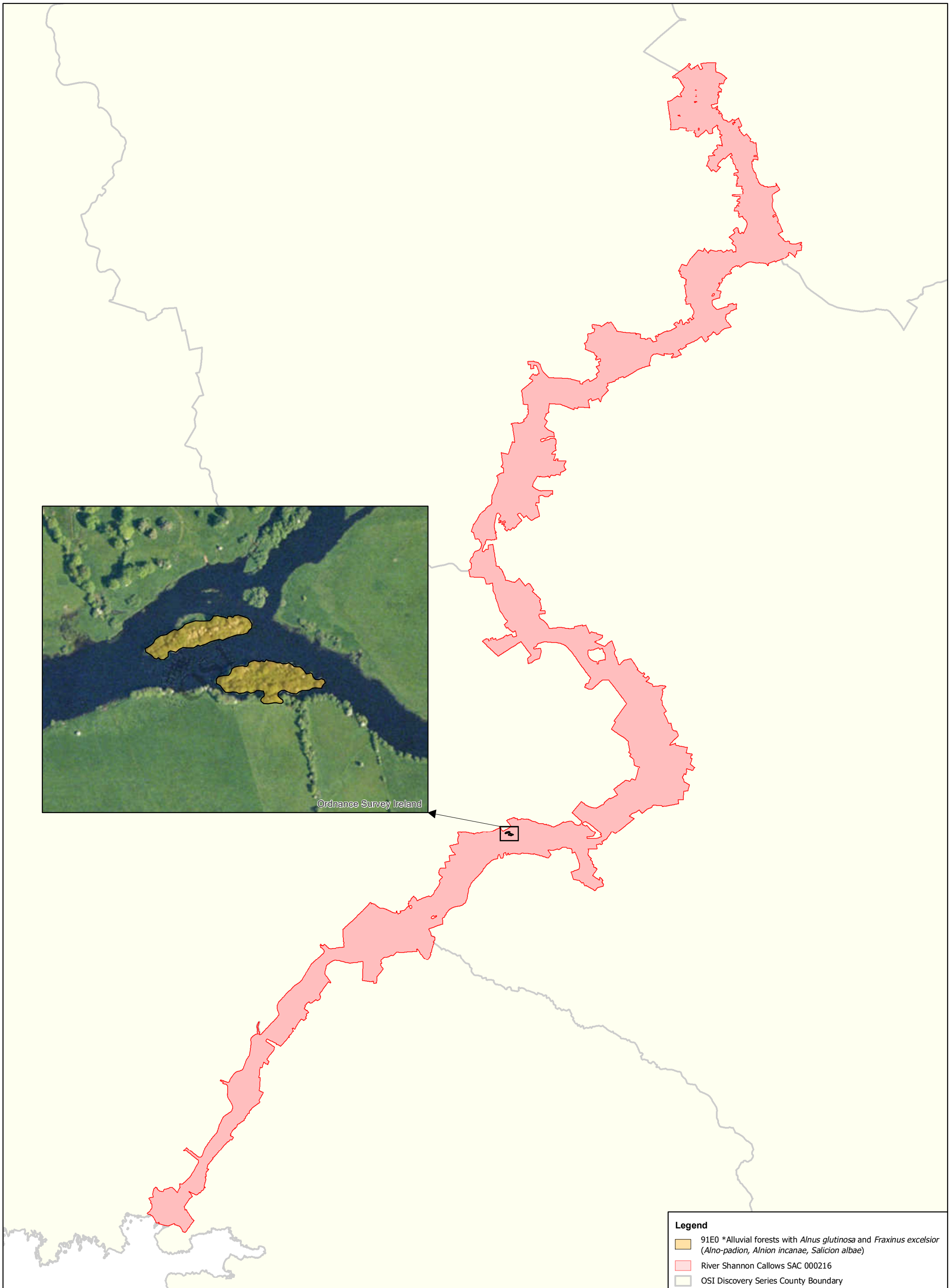


- Legend**
- 7230 Alkaline fens
 - River Shannon Callows SAC 000216
 - OSI Discovery Series County Boundary



Legend

- 8240 *Limestone pavements
- River Shannon Callows SAC 000216
- OSI Discovery Series County Boundary



Legend

- 91E0 *Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (*Alno-padion*, *Alnion incanae*, *Salicion albae*)
- River Shannon Callows SAC 000216
- OSI Discovery Series County Boundary