

National Parks and Wildlife Service

Conservation Objectives Series

Lough Forbes Complex SAC 001818



An Roinn
Ealaíon, Oidhreachta agus Gaeltachta

Department of
Arts, Heritage and the Gaeltacht



**National Parks and Wildlife Service,
Department of Arts, Heritage and the Gaeltacht,**

7 Ely Place, Dublin 2, Ireland.

Web: www.npws.ie

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

Citation:

**NPWS (201) Conservation Objectives: Lough Forbes Complex SAC 001818.
Version 1. National Parks and Wildlife Service, Department of Arts, Heritage
and the Gaeltacht.**

Series Editor: Rebecca Jeffrey

ISSN 2009-4086

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

001818	Lough Forbes Complex SAC
3150	Natural eutrophic lakes with Magnopotamion or Hydrocharition - type vegetation
7110	Active raised bogsE
7120	Degraded raised bogs still capable of natural regeneration
7150	Depressions on peat substrates of the Rhynchosporion
91E0	Alluvial forests with <i>Alnus glutinosa</i> and <i>Salix alba</i> (Alno-Padion, Alnion incanae, Salicion albae)E

Please note that this SAC adjoins Clooneen Bog SAC (002348). See map 2. The conservation objectives for this site should be used in conjunction with those for the adjacent site 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 :	1984
Title :	The vegetation of Irish lakes
Author :	Heuff, H.
Series :	Unpublished report to NPWS
Year :	2000
Title :	A survey of broadleaf woodlands in three SACs: Barrow-Nore, River Unshin and Lough Forbes
Author :	Browne, A.; Dunne, F.; Roche, N.
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 :	2013
Title :	A survey of the benthic macrophytes of three hard-water lakes: Lough Bunny, Lough Carra and Lough Owel
Author :	Roden, C.; Murphy, P.
Series :	Irish Wildlife Manual No. 70
Year :	2013
Title :	Results of monitoring survey of old sessile oak woods and alluvial forests
Author :	O'Neill, F.H.; Barron, S.J.
Series :	Irish Wildlife Manual no. 71
Year :	2013
Title :	The status of EU protected habitats and species in Ireland. Volume 2. Habitats assessments
Author :	NPWS
Series :	Conservation assessments
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 :	Ballykenny Bog (SAC 001818), Co. Longford, 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 : Fisherstown Bog (SAC 001818), Co. Longford, Site Report
Author : Fernandez, F.; Connolly, K.; Crowley, W.; Denyer J.; Duff K.; Smith G.
Series : Raised bog monitoring and assessment survey 2013

Year : 2015
Title : Habitats Directive Annex I lake habitats: a working interpretation for the purposes of site-specific conservation objectives and Article 17 reporting
Author : O Connor, Á.
Series : Unpublished document by NPWS

Year : 2016
Title : Lough Forbes Complex SAC (site code: 1818) Conservation objectives supporting document- raised bog habitats V1
Author : NPWS
Series : Conservation objectives supporting document

Other References

Year : 1982
Title : Eutrophication of waters. Monitoring assessment and control
Author : OECD
Series : OECD, Paris

Year : 1998
Title : The Shannon. In: Moriarty, C. (ed). Studies of Irish rivers and lakes
Author : Bowman, J.
Series : Marine Institute, Dublin

Year : 1998
Title : Macrophytes in Irish lakes and rivers: an overview of investigations and current knowledge. In: Giller, P.S. (Ed.). Studies in Irish limnology
Author : King, J.; Caffrey, J.
Series : Marine Institute, Dublin

Year : 2000
Title : Colour in Irish lakes
Author : Free, G.; Allott, N.; Mills, P.; Kennelly, C.; Day, S.
Series : Verhandlungen Internationale Vereinigung für theoretische und angewandte Limnologie. 27: 2620-2623

Year : 2001
Title : Aquatic plants in Britain and Ireland
Author : Preston, C.D.; Croft, J.M.
Series : Harley Books, Colchester

Year : 2002
Title : Reversing the habitat fragmentation of British woodlands
Author : Peterken, G.
Series : WWF-UK, London

Year : 2006
Title : 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)
Author : Free, G.; Little, R.; Tierney, D.; Donnelly, K.; Coroni, R.
Series : EPA, Wexford

Year : 2006
Title : Vegetation communities of British Lakes: a revised classification
Author : Duigan, C.A.; Kovach, W.L.; Palmer, M.
Series : Joint Nature Conservation Committee, Peterborough

Year : 2008
Title : Water Quality in Ireland 2004-2006
Author : Clabby, K.J.; Bradley, C.; Craig, M.; Daly, D.; Lucey, J.; McGarrigle, M.; O'Boyle, S.; Tierney, D.; Bowman, J.
Series : EPA, Wexford

Year : 2009
Title : The identification, characterization and conservation value of isoetid lakes in Ireland
Author : Free G.; Bowman, J.; McGarrigle, M.; Little, R.; Coroni, R.; Donnelly, K.; Tierney, D.; Trodd, W.
Series : Aquatic Conservation: Marine and Freshwater Ecosystems 19 (3): 264–273

Year : 2010
Title : Water quality in Ireland 2007-2009
Author : McGarrigle, M., Lucey, J.; Ó Cinnéide, M.
Series : EPA, Wexford

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 : 2014
Title : Nitrogen deposition and exceedance of critical loads for nutrient nitrogen in Irish grasslands
Author : Henry, J.; Aherne, J.
Series : Science of the Total Environment 470–471: 216–223

Year : 2015
Title : Water quality in Ireland 2010-2012
Author : Bradley, C.; et al.
Series : EPA, Wexford

Year : in prep.
Title : Monitoring of hard-water lakes in Ireland using charophytes and other macrophytes
Author : Roden, C.; Murphy, P.
Series : Unpublished report to NPWS

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 :	3150 (map 3)
<hr/>	
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 4 and 6)
<hr/>	
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 5)
<hr/>	
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 :	91E0 (map 7)
<hr/>	

Conservation Objectives for : Lough Forbes Complex SAC [001818]

3150 Natural eutrophic lakes with Magnopotamion or Hydrocharition - type vegetation

To restore the favourable conservation condition of Natural eutrophic lakes with Magnopotamion or Hydrocharition-type vegetation in Lough Forbes 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	Little is known about the characteristics or ecology of this habitat in Ireland. It is associated with base-rich lakes, with circumneutral or higher pH, in low-lying, large, naturally more productive catchments and is characterised by high abundance and diversity of pondweeds (<i>Potamogeton</i> spp.) and mesotrophic values for total phosphorus and chlorophyll. It is considered to occur in Lough Forbes in this SAC (see map 3), as well as other Shannon lakes. 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)
Habitat distribution	Occurrence	No decline, subject to natural processes	As noted above, habitat 3150 is considered to occur in Lough Forbes (map 3)
Typical species	Occurrence	Typical species present, in good condition, and demonstrating typical abundances and distribution	For lists of typical plant species, see Article 17 habitat assessment for 3150 (NPWS, 2013) and the lake habitats supporting document (O Connor, 2015). King and Caffrey (1998) summarise the findings of a macrophyte study of the Shannon-Erne systems. Lough Forbes has extensive reedbeds of <i>Scirpus lacustris</i> , <i>Phragmites australis</i> , with <i>Phalaris arundinacea</i> , <i>Nuphar lutea</i> , <i>Lemna trisulca</i> , <i>Equisetum fluviatile</i> , <i>Oenanthe crocata</i> , <i>Sparganium erectum</i> , as well as <i>Glyceria maxima</i> , <i>Sagittaria sagittifolia</i> and <i>Rumex hydrolapathum</i> (NPWS internal files). <i>Elodea canadensis</i> and <i>Potamogeton lucens</i> occur, but submerged flora appears to be limited (EPA data), possibly owing to eutrophication, elevated colour and/or turbidity
Vegetation composition: characteristic zonation	Occurrence	All characteristic zones should be present, correctly distributed and in good condition	The characteristic zonation of lake habitat 3140 has been described (Roden and Murphy, 2013; in prep.), however significant further work is necessary to describe the characteristic zonation and other spatial patterns in the remaining Annex I four lake habitats, including 3150. Zonation may be limited in Lough Forbes owing to the impacts of water quality
Vegetation distribution: maximum depth	Metres	Restore maximum depth of vegetation, subject to natural processes	The maximum depth of vegetation is likely to be specific to the lake shoreline in question. An indicative target of >6m has been developed for hard water lakes (3140) (see Roden and Murphy, 2013; in prep.). Indicative targets will be developed for the other lake habitats with time. The maximum depth of vegetation in Lough Forbes is generally <3m (EPA data) and is likely to have been reduced as a result of eutrophication, artificially increased colour and/or increased turbidity

Hydrological regime: water level fluctuations	Metres	Maintain appropriate natural 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 and drainage. 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. Flow in the Shannon has been controlled for navigation purposes for over 200 years (Bowman, 1998). The hydrological regime of the lakes must be maintained so that the area, distribution and depth of the lake habitat and its constituent/characteristic vegetation zones and communities are not reduced
Lake substratum quality	Various	Maintain appropriate substratum type, extent and chemistry to support the vegetation	Research is required to further characterise the substratum types (particle size and origin) and substratum quality (notably pH, calcium, iron and nutrient concentrations) favoured by each of the five Annex I lake habitats in Ireland. It is likely that soft muddy substrata dominate habitat 3150. Substratum particle size is likely to vary with depth and along the shoreline within a single lake
Water quality: transparency	Metres	Maintain/restore 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 has been set for hard water lakes (3140), however specific targets have yet to be established for the remaining lake habitats. Habitat 3150 is associated with lower transparency than the other lake habitats. The OECD fixed boundary system set transparency targets for mesotrophic lakes of 6-3m annual mean Secchi disk depth, and 3-1.5m annual minimum Secchi disk depth
Water quality: nutrients	µg/l P; mg/l N	Restore the concentration of nutrients in the water column to sufficiently low levels to support the habitat and its typical species	As a relatively productive habitat, mesotrophic and Water Framework Directive 'good' status targets apply. Where a lake has nutrient concentrations that are lower than these targets, there should be no decline within class, i.e. no upward trend in nutrient concentrations. For lake habitat 3150, annual average TP concentration should be ≤20µg/l TP, average annual total ammonia concentration should be ≤0.065mg/l N and annual 95th percentile for total ammonia should be ≤0.140mg/l N. Lough Forbes had moderate nutrient condition status in 2007-2009 and 2010-12 (McGarrigle et al., 2010; Bradley et al., 2015) and 25µg/l TP (Free et al., 2006). See also The European Communities Environmental Objectives (Surface Waters) Regulations 2009
Water quality: phytoplankton biomass	µg/l Chlorophyll <i>a</i>	Maintain appropriate water quality to support the habitat, including good chlorophyll <i>a</i> status	Mesotrophic and Water Framework Directive 'good' status targets apply to habitat 3150. Where a lake has a chlorophyll <i>a</i> concentration that is lower than this target, there should be no decline within class, i.e. no upward trend in phytoplankton biomass. The average growing season (March-October) chlorophyll <i>a</i> concentration must be <10µg/l. The annual average chlorophyll <i>a</i> concentration should be 2.5-8.0µg/l and the annual peak chlorophyll <i>a</i> concentration should be 8.0-25.0µg/l (OECD, 1982). Lough Forbes had good nutrient condition status in 2007-2009 and 2010-12 (McGarrigle, et al., 2010; Bradley, et al., 2015). Phytoplankton biomass may be limited by zebra mussel filtration in the lake. See also The European Communities Environmental Objectives (Surface Waters) Regulations 2009
Water quality: phytoplankton composition	EPA phytoplankton composition metric	Maintain appropriate water quality to support the habitat, including good phytoplankton composition status	The EPA has developed a phytoplankton composition metric for nutrient enrichment of Irish lakes. As for other water quality indicators, habitat 3150 requires WFD good status

Water quality: attached algal biomass	Algal cover and EPA phytobenthos metric	Maintain trace/ absent attached algal biomass (<5% cover) and good phytobenthos status	Nutrient enrichment can favour epiphytic and epipellic algae that can out-compete the submerged vegetation. The cover abundance of attached algae in habitat 3150 should, ideally therefore, be trace/ absent (< 5% cover). EPA phytobenthos can be used as an indicator of changes in attached algal biomass. As for other water quality indicators, habitat 3150 is considered to require good phytobenthos status
Water quality: macrophyte status	EPA macrophyte metric (The Free Index)	Restore good macrophyte status	Nutrient enrichment can favour more competitive submerged macrophyte species that out-compete the typical and characteristic species for the lake habitat. The EPA monitors macrophyte status for Water Framework Directive purposes using the 'Free Index'. The target for lake habitat 3150 is good status or an Ecological Quality Ratio (EQR) for lake macrophytes of ≥ 0.68 , as defined in Schedule Five of the European Communities Environmental Objectives (Surface Waters) Regulations 2009. Bradley et al. (2015) reported moderate macrophyte status for Lough Forbes
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 habitat 3150, in terms of water and sediment pH, alkalinity and cation concentration, have not been fully determined. Acidification is not considered a threat to habitat 3150, 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 The European Communities Environmental Objectives (Surface Water Objectives) Regulations 2009
Water colour	mg/l PtCo	Restore appropriate water colour to support the habitat	Increased water colour and turbidity decrease light penetration and can reduce the area of available habitat for lake macrophytes, particularly at the lower euphotic depths. The primary source of increased water colour in Ireland is disturbance to peatland. No habitat-specific or national standards for water colour currently 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). It is likely that the water colour in all Irish lake habitats would naturally be <50mg/l PtCo. High colour of 42mg/l PtCo has been reported in Lough Forbes (Free et al., 2006)
Dissolved organic carbon (DOC)	mg/l PtCo	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 units	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 : Hectares
area

Maintain the area and
condition of fringing
habitats necessary to
support the natural
structure and functioning
of the lake habitat

3150 lakes typically have well-developed reedswamp, fen and/or marsh communities around much of their shoreline. Wet woodland would have surrounded much of their shoreline in the past and has survived or re-colonised patches of many 3150 lake shores. These fringing habitats 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. Reedbeds are extensive in Lough Forbes and marsh is also common. The SAC is also selected for the Annex I habitats active raised bogs (7110) and alluvial woodland (91E0), which occurs around Lough Forbes and along the River Shannon and its tributaries. Willow, ash-alder and ash-oak woodlands occur

7110 Active raised bogs

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

Attribute	Measure	Target	Notes
Habitat area	Hectares	Restore the area of active raised bog to 43.5ha, subject to natural processes	Active Raised Bog (ARB) habitat was mapped at 9.0ha by Fernandez et al. (2014). Area of Degraded Raised Bog (DRB) on the High Bog (HB) has been modelled as 61.6ha. See map 4. However, it is estimated that only 33.5ha is potentially restorable to ARB by drain blocking. The total potential ARB on the HB is therefore estimated to be 42.5ha. Eco-hydrological assessments of the cutover estimates that an additional 1.0ha of bog forming habitats could be restored. The long term target for ARB is therefore 43.5ha. 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 5 for distribution in 2011/2012	ARB currently occurs in numerous small areas throughout the high bog, mainly on Ballykenny Bog. DRB occurs over much of the remainder of the high bog at both Ballykenny Bog and Fisherstown Bog and will require restoration measures. There is also potential for ARB restoration on cutover areas of the bog (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 4	The total area of high bog within Ballykenny Bog and Fisherstown Bog in 2012 (latest figure available) was 283.2ha (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 6 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
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	Peat-cutting has occurred in the past around the eastern and northern margins of both bogs, and on the western side of Fisherstown Bog. Natural and semi-natural margins occur elsewhere and there are interesting transitions between the high bog to adjacent wetland habitats. Eco-hydrological assessments have evaluated the potential for ARB restoration on cutover areas (see note for habitat area attribute above). See also the conservation objectives for other Annex I habitats 3150 and 91E0
Vegetation quality: central ecotope, active flush, soaks, bog woodland	Hectares	Restore 21.8ha 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 43.5ha (see area target above)
Vegetation quality: microtopographical features	Hectares	Restore adequate cover of high quality microtopographical features	High quality microtopography (hummocks, hollows and pools) is well developed in the ARB areas of Ballykenny and Fisherstown Bogs

Vegetation quality: bog moss (<i>Sphagnum</i>) species	Percentage cover	Restore adequate cover of bog moss (<i>Sphagnum</i>) species to ensure peat-forming capacity	<i>Sphagnum</i> cover varies naturally across Ireland with relatively high cover in the east to lower cover in the west. Hummock forming species such as <i>Sphagnum austini</i> are particularly good peat formers. <i>Sphagnum</i> 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	Ballykenny and Fisherstown Bogs are noted for the presence of a natural gradation from the bogs to the Camlin river, where there are large expanses of callows which remain relatively undisturbed. To the south of Fisherstown Bog, there is a natural lagg zone where the bog slopes to the river
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 (<i>Narthecium ossifragum</i>), deergrass (<i>Trichophorum germanicum</i>) and harestail cotton-grass (<i>Eriophorum vaginatum</i>) forming tussocks; abundant magellanic bog-moss (<i>Sphagnum magellanicum</i>) in pools previously dominated by <i>Sphagnum</i> species typical of very wet conditions (e.g. feathery bog-moss (<i>S. cuspidatum</i>)); and indicators of frequent burning events such as abundant <i>Cladonia floerkeana</i> and high cover of carnation sedge (<i>Carex panicea</i>) (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 (<i>Pinus contorta</i>), rhododendron (<i>Rhododendron ponticum</i>) and pitcherplant (<i>Sarracenia purpurea</i>)
Air quality: nitrogen deposition	kg N/ha/yr	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 Lough Forbes Complex SAC suggests that the current level is approximately 15.5kg 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 marginal areas surrounding the high bog varies due to influences of different water types (bog water, regional groundwater, and run-off from surrounding mineral lands)

Conservation Objectives for : Lough Forbes Complex SAC [001818]

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 Lough Forbes Complex SAC

Attribute	Measure	Target	Notes
------------------	----------------	---------------	--------------

Conservation Objectives for : Lough Forbes Complex SAC [001818]

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 Lough Forbes Complex SAC

Attribute	Measure	Target	Notes
-----------	---------	--------	-------

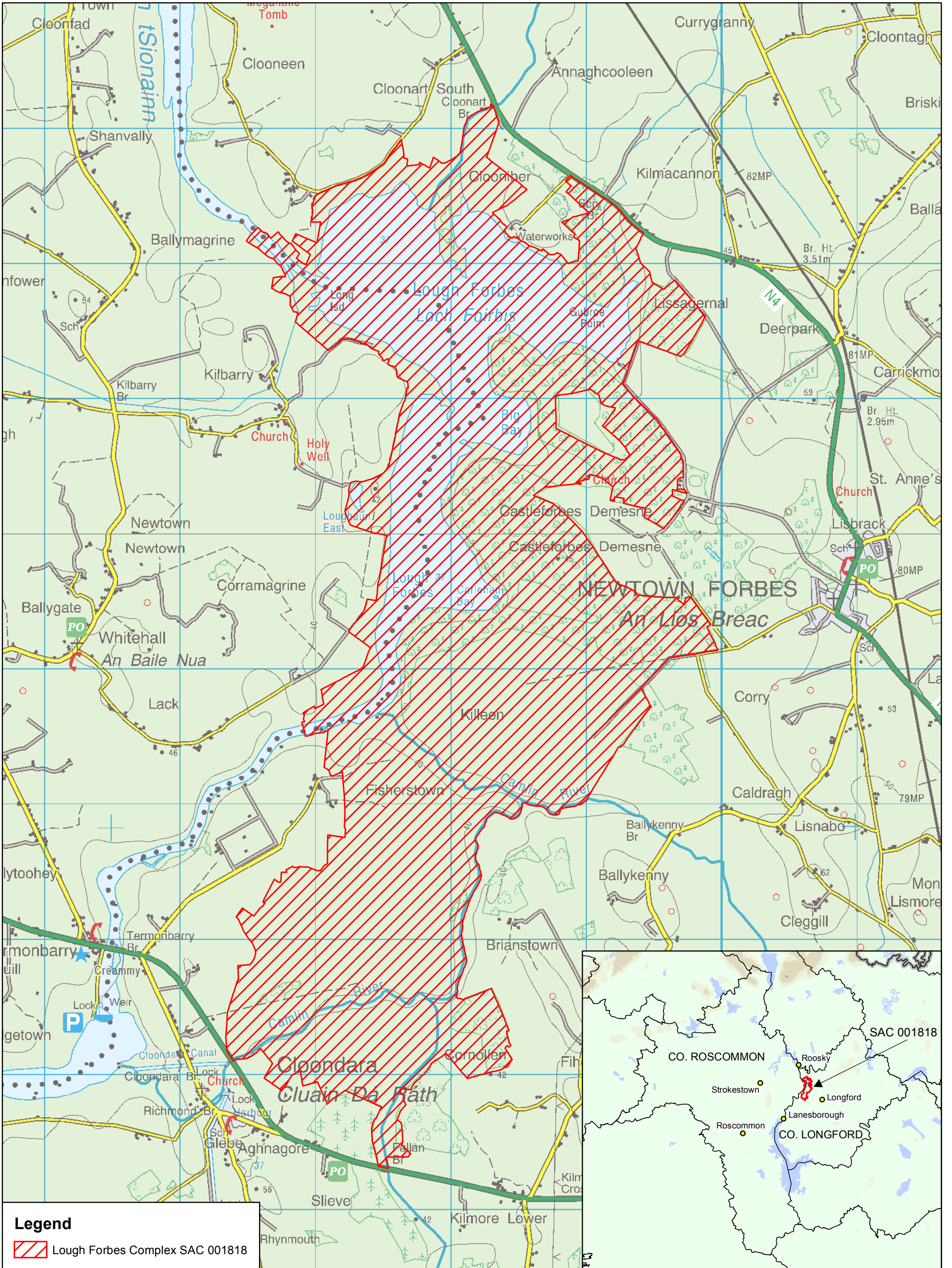
Conservation Objectives for : Lough Forbes Complex SAC [001818]

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

To restore the favourable conservation condition of Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (Alno-Padion, Alnion incanae, Salicion albae) in Lough Forbes 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	Woodlands within the SAC were surveyed by Browne et al. (2000) and incorporated into the National Survey of Native Woodlands dataset (NSNW) Perrin et al. (2008) (sites 0540, 0541, 0542, 0543, 0544, 0546, 0547). Site 0544 (Gubro) was included in a national monitoring survey (O'Neill and Barron, 2013). Map 7 shows surveyed woodlands, including areas classified as 91E0 (10.6ha). NB other areas mapped as wet woodland types may also correspond with this Annex I woodland type
Habitat distribution	Occurrence	No decline. Woodland locations shown on map 7	See note or 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 (<i>Alnus glutinosa</i>) and oak (<i>Quercus</i> spp.) regenerate poorly. Ash (<i>Fraxinus excelsior</i>) 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 but not for woodland around springs/seepage areas
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 distinctiveness	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) identify one site within the SAC (Gubroe) as being "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)

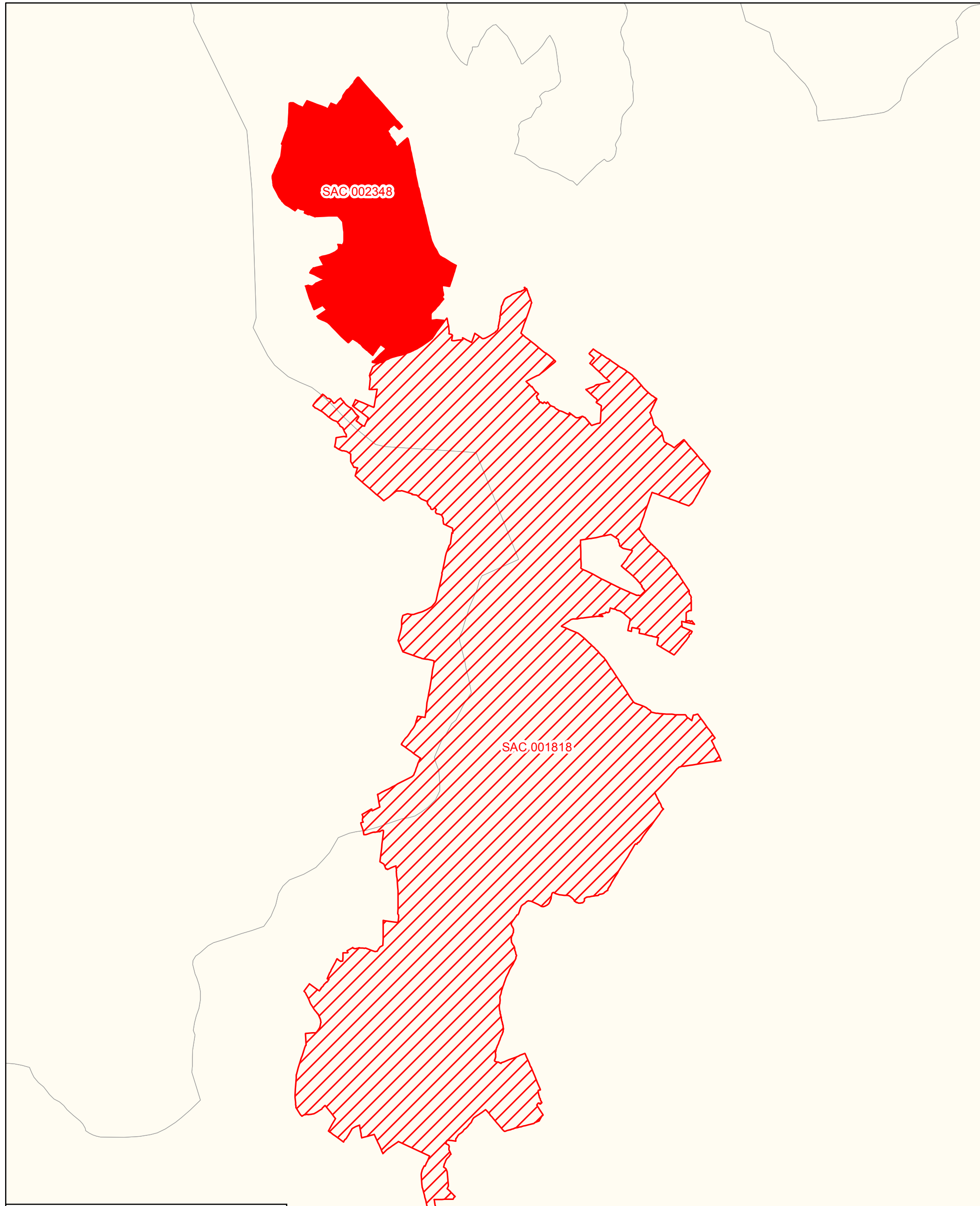
Vegetation composition: typical species	Occurrence	A variety of typical native species present, depending on woodland type, including alder (<i>Alnus glutinosa</i>), willows (<i>Salix</i> spp.), oak (<i>Quercus robur</i>) and ash (<i>Fraxinus excelsior</i>)	Species reported in Perrin et al. (2008)
Vegetation 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 (<i>Acer pseudoplatanus</i>) and Himalayan balsam (<i>Impatiens glandulifera</i>). Rhododendron (<i>Rhododendron ponticum</i>) and laurel (<i>Prunus laurocerasus</i>) are well established in this SAC



Legend

 Lough Forbes Complex SAC 001818






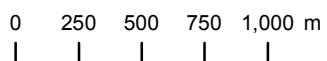


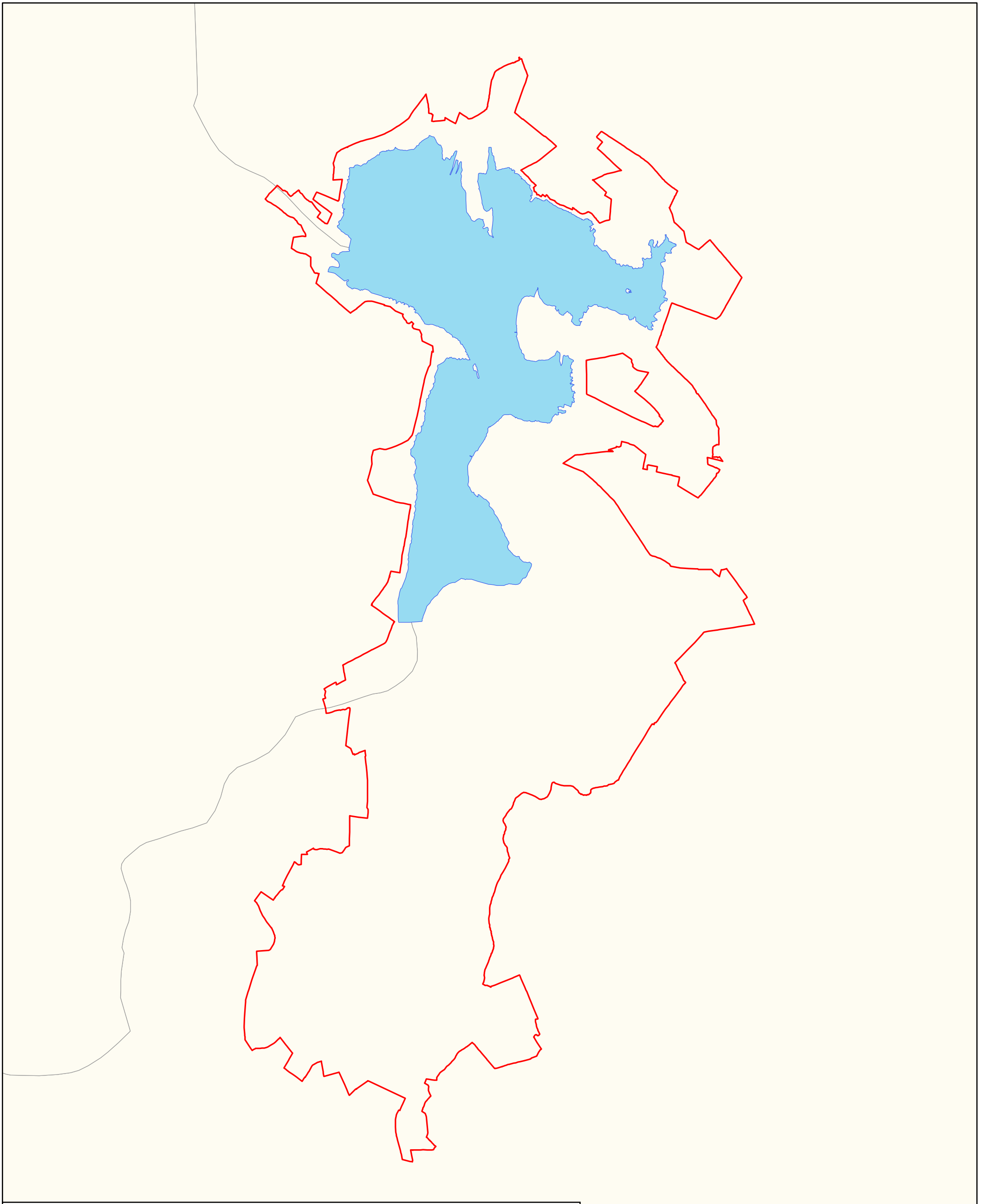
SAC 002348

SAC 001818

Legend

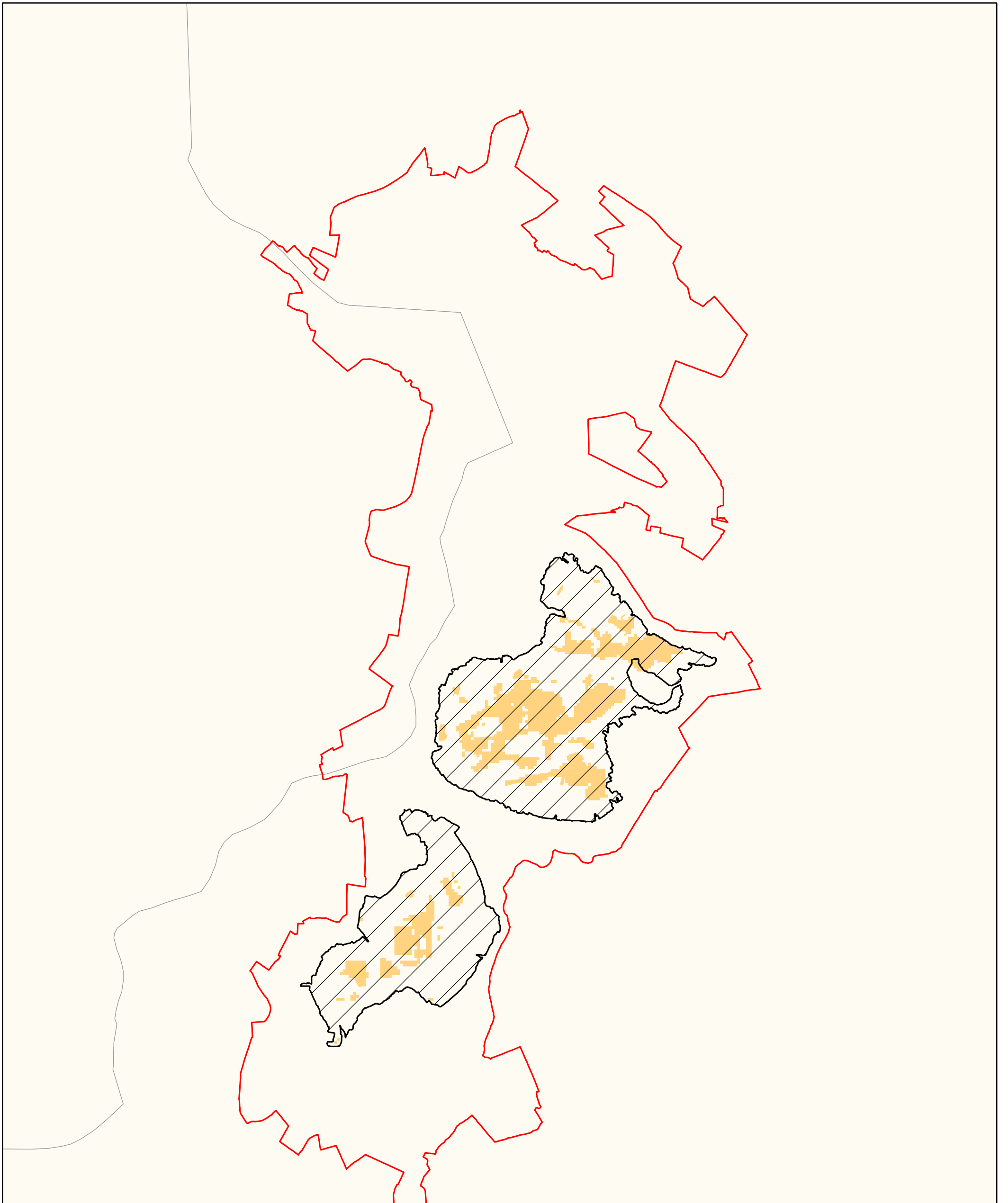
-  Lough Forbes Complex SAC 001818
-  Clooneen Bog SAC 002348
-  OSi Discovery Series County Boundary





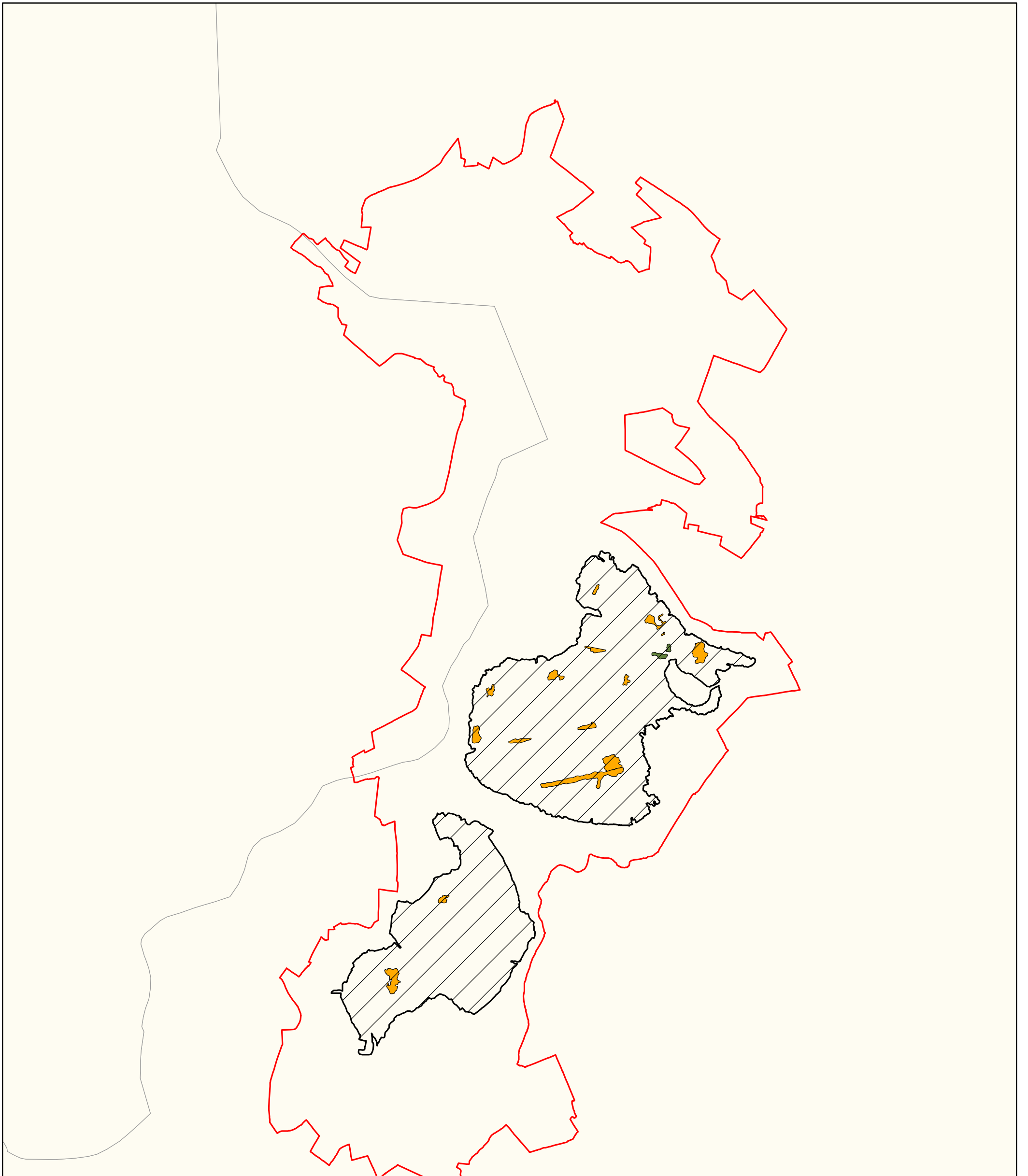
Legend

- Lough Forbes Complex SAC 001818
- Potential 3150 Natural eutrophic lakes with Magnopotamion or Hydrocharition-type vegetation
- OSi Discovery Series County Boundary



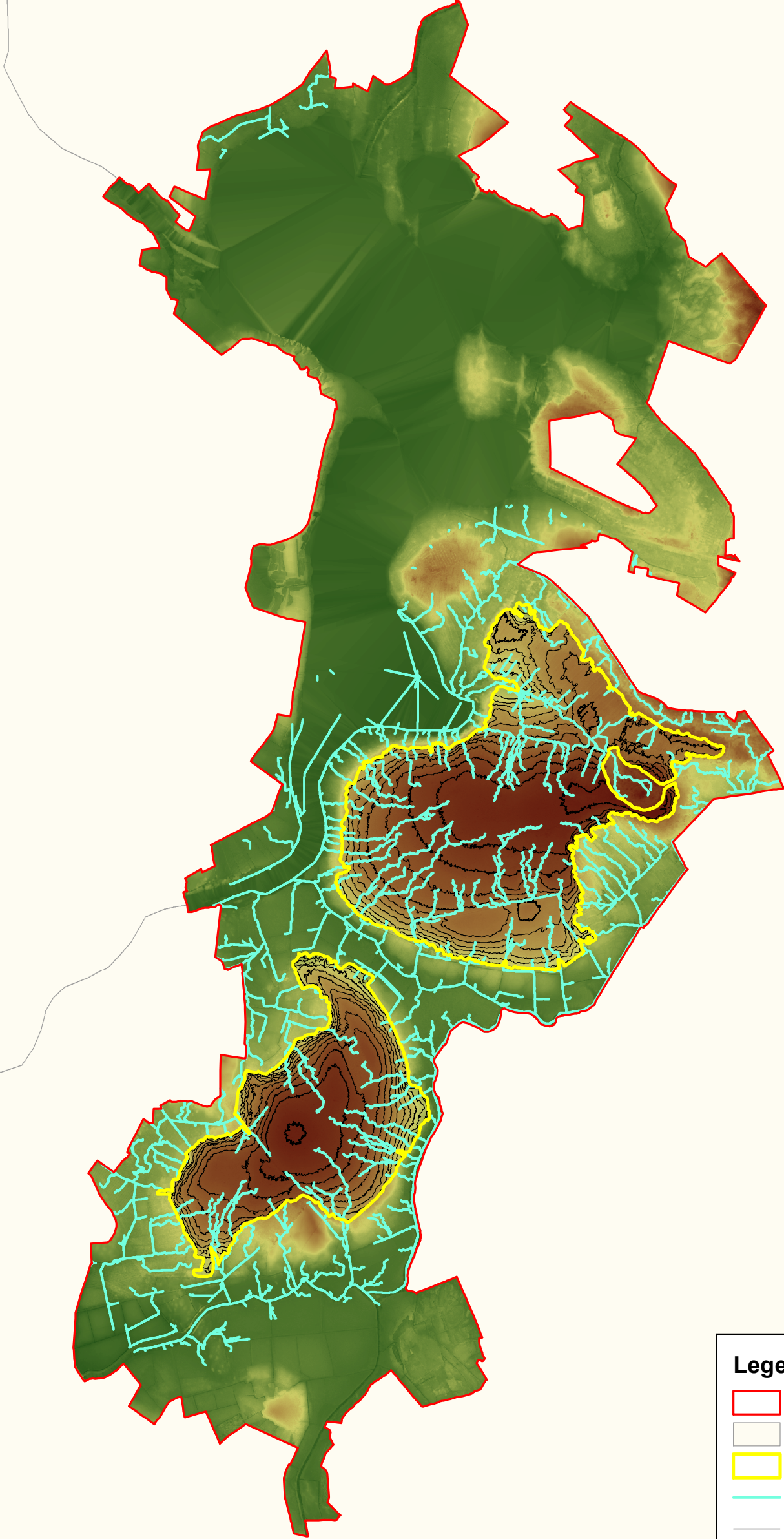
Legend

- Lough Forbes Complex SAC 001818
- High Bog Boundary
- Potential 7110 *Active Raised Bogs
- OSi Discovery Series County Boundary



Legend

- Lough Forbes Complex SAC 001818
- OSi Discovery Series County Boundary
- High Bog Boundary
- Active Raised Bogs Ecotopes**
- Soaks / active flush
- Sub-central ecotope



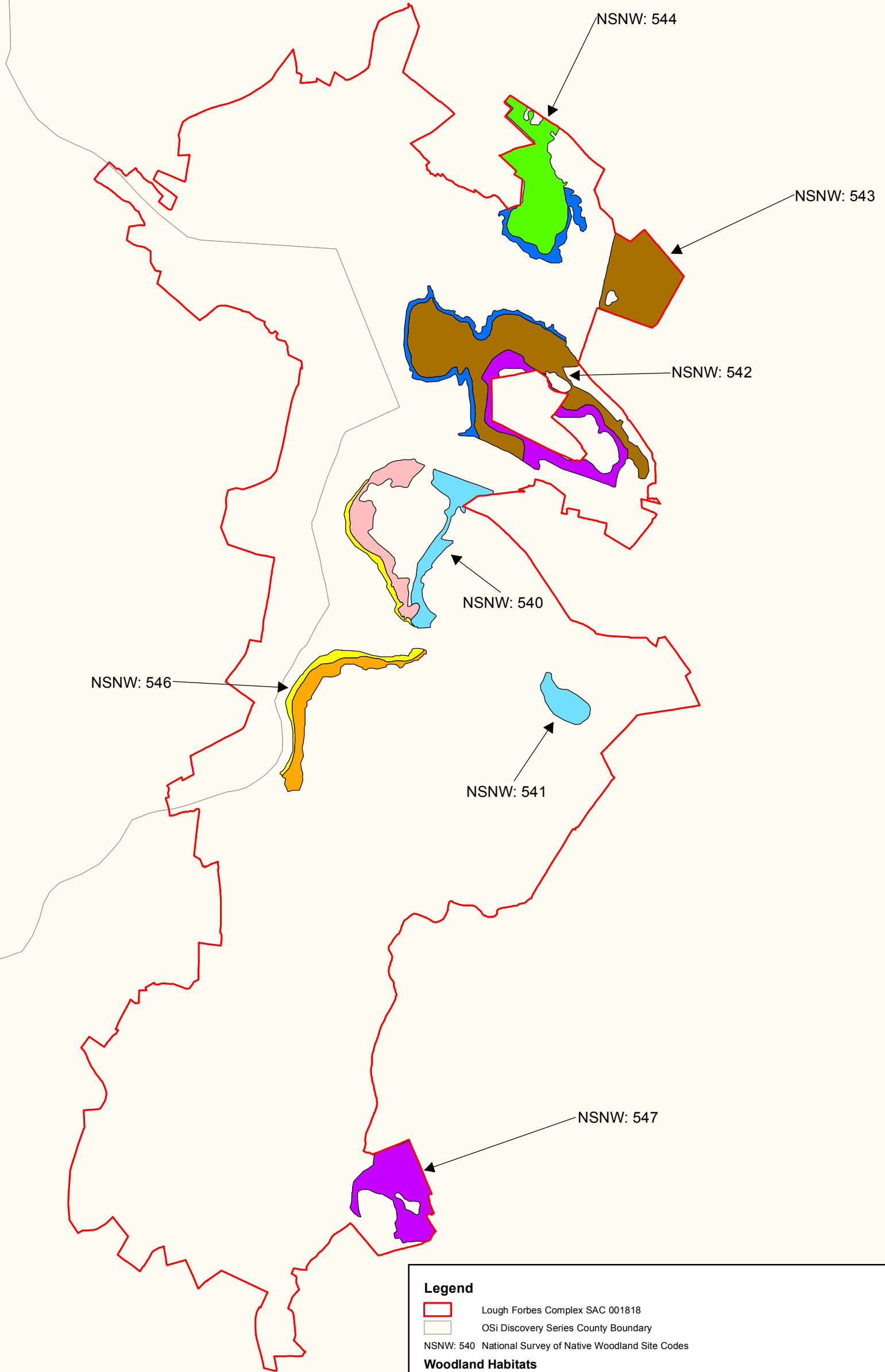
Legend

- Lough Forbes Complex SAC 001818
- OSi Discovery Series County Boundary
- High Bog Boundary
- Drainage Patterns
- Contours

Elevation

47.15m

36.36m



Legend

- Lough Forbes Complex SAC 001818
- OSI Discovery Series County Boundary
- NSNW: 540 National Survey of Native Woodland Site Codes

Woodland Habitats

Qualifying Interests

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

Non Qualifying Interests

- 91A0 Old sessile oak woods with *Ilex* and *Blechnum* in the British Isles
- WD1 (Mixed) broadleaved woodland
- WN2 Oak-ash-hazel woodland
- WN2 / WN4, Oak-ash-hazel woodland / Wet pedunculate oak-ash woodland
- WN2 / WN4 / WN7, Oak-ash-hazel woodland / Wet pedunculate oak-ash woodland / Bog woodland
- WN6 Wet willow-alder-ash woodland
- WN7 Bog woodland