NPWS

Lower River Shannon SAC

(site code 2165)

Conservation objectives supporting document- Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation (habitat code 3260)

Version 1

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Contents

1 Introduction

1.1 Lower River Shannon SAC

Lower River Shannon Special Area of Conservation (site code 002165) is a large site that encompasses the lower reaches of the River Shannon extending from just south of Lough Derg at its eastern end to a line drawn from Loop Head to Kerry Head at the west. The Mulkear and Feale rivers are included in the site as well as the lower portions of others, such as the Fergus and Maigue.

The site is selected for 14 habitats listed in Annex I of the Habitats Directive and seven species in Annex II.

"Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation" (habitat code 3260) is a habitat in Annex I of the Habitats Directive. The description of the habitat is broad, covering rivers from upland bryophyte and macroalgal dominated stretches, to lowland depositing rivers with pondweeds and starworts (European Commission, 2007, Hatton-Ellis and Grieve, 2003). Selection of Special Areas of Conservation for the habitat in Ireland has used this broad interpretation. Thus, it must be recognised that a number of sub-types of this habitat exist in Ireland. As in the UK, it is considered that the habitat as defined is too broad for a single set of conservation guidelines to cover it (Hatton-Ellis and Grieve, 2003). Site-specific conservation objectives for the habitat identify and concentrate upon the high-conservation value sub-types.

The full distributions of this habitat and its sub-types in this site are currently unknown. The basis for the selection of the SAC for the habitat was the presence of plant species that are listed as characteristic of the habitat, such as Batrachian species of *Ranunculus*, *Potamogeton* spp. and *Fontinalis antipyretica* Hedw., (European Commission, 2007). These taxa were recorded during the NHA survey. The presence of rare and protected macrophyte species was also noted.

Review of the available data identifies three high conservation elements (sub-types) in the site, namely:

1. *Groenlandia densa* (L.) Fourr., Opposite-leaved Pondweed
2. *Schoenoplectus triqueter* (L.) Palla, Triangular Club-rush
3. Bryophyte-rich streams and rivers

The first two sub-types are associated with tidal reaches of rivers, while the latter sub-type is found in fast-flowing stretches of unmodified streams and rivers. In addition to these three sub-types, it is likely that other high-conservation value sub-types exist within the site. Further investigation of all sub-types is required.

There are stretches of six main rivers in the Lower River Shannon SAC: the Shannon, the Cloon, the Fergus, the Mulkear, the Maigue and the Feale. The high conservation value areas influenced by the tide are found, most notably, in the Shannon, the Fergus and the Maigue. The catchments of these three rivers are dominated by limestone geology. Significant non-tidal stretches of the Cloon, the Mulkear and the Feale are also included in the site. These three systems vary in character, with the Mulkear catchment heavily influenced by base-rich geology (Carboniferous limestone), while the Cloon and Feale catchments are dominated by Namurian sandstones and shales. The Cloon is a fast, short, coastal river with a small (c. 59 km^2), lowland catchment (DEHLG, 2010). In contrast, the Feale and Mulkear catchments are larger, having both upland streams and rivers and significant lowland stretches; the Feale rising in the Mullaghareirk Mountains, the Mulkear in the Silvermines.

1.2 High-conservation value sub-types within the Lower River Shannon SAC

Each of the three recognised sub-types of the habitat Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation is dealt with in turn below.

1.2.1 *Groenlandia densa*, Opposite-leved Pondweed

Groenlandia densa is a pondweed found in calcareous waters in rivers, streams, canals, ditches and ponds (Preston and Croft, 2001, Preston, 2003). In Ireland, it is typically associated with tidal stretches of rivers and other periodically disturbed watercourses (e.g. canals and drains), where it presumably benefits from the reduction in competition through disturbance. It has declined in Ireland (Preston and Croft, 2001, Preston, 2003) and is protected under the Wildlife Acts (1976 and 2000), being listed on the Flora Protection Order 1999.

1.2.2 *Schoenoplectus triqueter*, Triangular Club-rush

Schoenoplectus triqueter, Triangular Club-rush, is a rare and highly threatened vascular plant species in Britain and Ireland, where it is restricted to tidal stretches of rivers (Preston and Croft, 2001, Preston et al., 2002, Rich and FitzGerald, 2002). It occurs in a variety of wetland and freshwaters elsewhere in the world (Rich and FitzGerald, 2002). All known Irish populations of the species are contained within or adjacent to the Lower River Shannon SAC, and it is locally abundant. It is protected under the Wildlife Acts (1976 and 2000), being listed on the Flora Protection Order 1999. The Triangular Club-rush is declining in Great Britain, and is extinct at three of its four sites (Preston and Croft, 2001, Rich and FitzGerald, 2002). It is also thought to be extinct from the Cashen River (Feale) (Rich and FitzGerald, 2002).

1.2.3 Bryophyte-rich streams and rivers

A rich bryophyte flora has been recorded from the Bilboa River, Mulkear catchment, including the Vulnerable *Schistidium platyphyllum* (Mitt.) H. Perss. and the Near Threatened *Philonotis caespitosa* Jur. (Lockhart 1992, Lockhart et al., 2012). The bryophyte-rich habitat was found in mature river stretches of 10-12 m, occasionally up to 20 m, wide, which varied from riffles and cascades to pools.

Cinclidotus riparius (Host ex Brid.) Arn. was recorded in the River Fergus near Ennis in 1884 by S.A. Stewart, but on all recent field visits, the water level has been too high to allow comprehensive searches (Lockhart et al., 2012). This species, in particular, requires further investigation in the Fergus and in other nearby rivers, lakes and turloughs.

In addition to these known important bryophyte-rich streams and rivers in the site, there are likely to be other stretches with bryophyte-rich sub-types. *Ephemerum crassinervium* (Schwägr.) Hampe subsp. *rutheanum* and *Ephemerum cohaerens* (Hedw.) Hampe are two mud-dwelling mosses associated with the draw-down zones of lowland rivers and lakes, respectively Near Threatened and Vulnerable, and both known from the River Shannon upstream of the site. *Fissidens monguillonii* Thér. is a Near Threatened moss, also associated with marginal fine substrata of rivers and lakes, that is known from two locations on the River Shannon: near Carrick-on-Shannon and the Shannon Callows.

There are many bryophytes that grow on rocks in and by streams and rivers, where they keep moist from the constant humidity or water splashes (Lockhart et al., 2012). The truly aquatic *Fontinalis antipyretica*, considered a characteristic species of Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation, is an aquatic generalist that can be found from some metres depth in lakes to periodically inundated areas, or just above it (Lockhart et al., 2012).

1.3 Drainage and the freshwater pearl mussel

The Feale and the Mulkear have both been heavily influenced by arterial drainage schemes, while land drainage, particularly of peatlands, has severely impacted the Cloon. These drainage activities will have altered distribution and species composition of the aquatic plant communities. Both the Cloon and Feale support small populations of *Margaritifera margaritifera* the freshwater pearl mussel, however only the Cloon population is listed on the European Communities Environmental Objectives (Freshwater Pearl Mussel) Regulations 2009.

Note: rooted macrophytes should be absent or trace (< 5% cover) in freshwater pearl mussel (*Margaritifera margaritifera*) habitat. The freshwater pearl mussel (1029) conservation objective takes precedence over this objective for habitat Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation in the Cloon River within this SAC, because the mussel requires environmental conditions closer to natural background levels.

1.4 Conservation objectives

A site-specific conservation objective aims to define the favourable conservation condition of a habitat or species at site level. The maintenance of habitats and species within sites at favourable condition will contribute to the maintenance of favourable conservation status of those habitats and species at a national level.

Conservation objectives are defined using attributes and targets that are based on parameters as set out in the Habitats Directive for defining favourable status, namely area, range, and structure and functions.

Attributes and targets may change/become more refined as further information becomes available.

2 Area

It is not generally possible to quantify the area of Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation in a site, as rivers are linear features of variable width, along which the habitat varies both spatially and temporally in its extent. Consequently, NPWS use length of occupied channel in kilometres as the quantitative measure for habitat area.

The target for habitat area is: stable or increasing, subject to natural processes.

While the known extent of the three sub-types has been broadly mapped within the SAC (See Section 3 below), the exact area of each has not been quantified. The area of the *Schoeoplectus triqueter* sub-type is likely to be smaller than the mapped range, however, as both the *Groenlandia densa* and the bryophyte-rich sub-types are presumed to be more widespread than mapped, it is not possible to comment on their areas at this time.

3 Range

The known distribution of Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation in the Lower River Shannon SAC is shown in Appendix 1. Specific comments on each of the three mapped sub-types are made below. These, and/or other high-conservation-value sub-types, may be more widespread in the site than mapped by NPWS.

The target for the habitat distribution attribute is: no decline, subject to natural processes.

3.1 *Groenlandia densa*, Opposite-leaved Pondweed

Groenlandia densa is known from the northern bank of the River Shannon at the Shannon (New) Bridge and also the Limerick (Park) Canal, Limerick City, "from near the River Shannon at its north-east end to the lock gates at its south-west end" (Reynolds et al., 2006) (see Appendix 1). The mapped distribution of the sub-type extends for c. 1.6 km. The species is likely to be more widespread in the tidal stretches of the Shannon and other rivers, as well as in marginal ditches. Abundant *Groenlandia densa* was found in the River Shannon at Killaloe in 2011, just upstream of the site boundary (M. Wyse Jackson pers. comm.), suggesting *Groenlandia densa* is probably also found throughout the non-tidal parts of the Shannon in the site.

3.2 *Schoenoplectus triqueter*, Triangular Club-rush

Within the site, *Schoenoplectus triqueter* is known from both banks of the Shannon between King's Island in Limerick City and Cratloe Creek (c. 9.5 km extent), and from the following rivers and creeks: Ballinacurra Creek (1.8 km), Crompaun River (or Meelick Creek) (1.6 km), Cratloe Creek (1.2 km), the River Maigue (10.5 km) and the Owenagarney (or Ratty) River (0.6 km) (Deegan and Harrington, 2004, Rich and FitzGerald, 2002)(see Appendix 1).

3.3 Bryophyte-rich streams and rivers

Lockhart (1992) noted the lower Bilboa River, particularly the steeply graded section above the confluence of the Gortnageragh River, as an excellent example of a relatively undisturbed, bryophyte-rich river system (see Appendix 1). The mapped distribution of the sub-type extends for c. 13 km. A bryophyte-dominated community was also recorded in the narrower (1-4 m wide) channels in the Mulkear system (Lockhart, 1992) and, as noted in Section 1.2.3, there is an old record for *Cinclidotus riparius* from the River Fergus near Ennis.

4 Structure and functions

Structure and functions relates to the physical components of a habitat ("structure") and the ecological processes that drive it ("functions"). For Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation these include attributes such as hydrology, substrata and various water quality attributes.

4.1 Hydrological regime

Owing to regular disturbance (through variations in flow), river macrophytes rarely reach a climax condition but frequently occur as transient communities. A natural (relatively unmodified) flow regime is required for both plant communities and channel geomorphology to be in favourable condition, exhibiting typical dynamics for the river type (Hatton-Ellis and Grieve, 2003). For many of the sub-types of this habitat, high flows are required to maintain the substratum necessary for the characteristic species (see Section 4.2 below). Flow variation is particularly important, with high and flood flows being critical to the hydromorphology. Other aspects of hydrological regime, such as groundwater discharge and tidal regime are important for certain sub-types of the habitat.

4.1.1 River flow

The target for hydrological regime, river flow is: maintain appropriate hydrological regimes.

4.1.1.1 *Groenlandia densa*, Opposite-leaved Pondweed

For the *Groenlandia densa* associated with the large, depositing stretches of the River Shannon, river flow is important to the provision of appropriate substrata. River flow variation may also contribute to the disturbance necessary for the species' persistence.

4.1.1.2 *Schoenoplectus triqueter*, Triangular Club-rush

River flow provides the critical supply of fine sediment occupied by *Schoenoplectus triqueter*. As this sub-type requires the deposition of fines, changes in flow and deposition-erosion patterns are a concern (Rich and FitzGerald, 2002).

4.1.1.3 Bryophyte-rich streams and rivers

This sub-type is associated with natural, fast and highly variable flows.

4.1.2 Tidal influence

The target for hydrological regime: tidal influence is: maintain natural tidal regime.

4.1.2.1 *Groenlandia densa*, Opposite-leaved Pondweed

Tidal regime appears to be an important influence on the distribution of *Groenlandia densa* in Ireland. The species is typical of the tidal reaches of other large Irish rivers, e.g. the Slaney, the Suir and the Blackwater (see Preston, 2003; Preston and Croft, 2001). Both the disturbance and substratum associated with the tidal regime may be important drivers.

Regular vegetation clearance in canals and drains also allows *Groenlandia* to thrive. The management regime in the Limerick Canal at the time of the rare and scarce vascular plant survey (regular clearance, leaving some plants to allow re-growth) was considered to suit the species (Reynolds et al., 2006).

4.1.2.2 *Schoenoplectus triqueter*, Triangular Club-rush

Schoenoplectus triqueter, Triangular Club-rush, is a tussock-forming, perennial that occurs in Britain and Ireland on mud-banks along the lower reaches of large tidal rivers, where conditions are weakly brackish to freshwater and fluctuations in water level are large (Preston and Croft, 2001, Preston et al., 2002, Rich and FitzGerald, 2002). It may become submerged at the highest tides (Preston and Croft, 2001, Preston et al., 2002). Outside Britain and Ireland, the species is rarely associated with fluctuating waters and the fluctuating water levels here may serve to reduce competition from other plant species (Rich and FitzGerald, 2002). Rich and FitzGerald (2002) consider Triangular Club-rush in a relict species in Britain and Ireland, where it is now restricted to a sub-optimal habitat where competition with other clonal swamp species is reduced.

4.1.3 Freshwater seepages

Freshwater seepages are considered important for both the *Groenlandia densa* and *Scheonoplectus triqueter* sub-types. These seepages may be from shallow or deep groundwater, and/or from surface run-off.

The target for hydrological regime: freshwater seepages is: maintain appropriate freshwater seepage regimes.

4.1.3.1 *Groenlandia dens*a, Opposite-leaved Pondweed

Groenlandia densa is found in a freshwater seepage area at the edge of the River Shannon (Reynolds et al., 2006). The water appears to discharge diffusely through the muds and to form rivulets of more concentrated flow.

4.1.3.2 *Schoenoplectus triqueter*, Triangular Club-rush

Schoenoplectus triqueter is tolerant of at least weakly saline conditions but does require freshwater inputs in the form of seepages or shallow, low-velocity surface flows (Stewart, 1999, Preston and Croft, 2001, Rich and FitzGerald, 2002). The populations along the Shannon are most likely to be found where freshwater seeps onto brackish mud (Praeger, 1934, Rich and FitzGerald, 2002).

4.1.3.3 Bryophyte-rich streams and rivers

Groundwater discharges may be important in some areas of the bryophyte-rich sub-type.

4.2 Substratum composition: particle size range

The size and distribution of substratum particles is largely determined by the river flow. Tides also play an important role in sediment sorting. Different habitat sub-types and species have different substratum requirements.

The target for substratum composition: particle size range is: The substratum should be dominated by the particle size ranges, appropriate to the habitat sub-type

4.2.1 *Groenlandia densa*, Opposite-leaved Pondweed

Groenlandia densa is found on a variety of substrata, typically silts (mud), and sometimes sands. It grows on stones in rivulets, as well as on fine silts and mud in the River Shannon (Reynolds et al., 2006). It is found on fine sediments in the Limerick Canal.

4.2.2 *Schoenoplectus triqueter*, Triangular Club-rush

Schoenoplectus triqueter is associated with bare tidal mud (Preston and Croft, 2001, Preston et al., 2002).

4.2.3 Bryophyte-rich streams and rivers

The river substratum in the bryophyte rich stretches is typically composed of stone and gravel, with rocks, boulders and sometimes bedrock in the riffles and cascades (Lockhart, 1992). *Schistidium platyphyllum* and *Philonotis caespitosa* are found on in-stream boulders in the Bilboa river.

4.3 Water quality: nutrients

Phosphorus (MRP) is typically the limiting nutrient, however increased nitrogen (NO_3^-) negatively impacts upon some aquatic plant communities. Nutrient enrichment typically leads to increased filamentous-green-algal biomass, and consequent changes in other algae, bryophyte and macrophyte species composition and abundance. Water quality should reach a minimum of Water Framework Directive good status, in terms of nutrient and oxygenation standards, and EQRs (Ecological Quality Ratios) for macroinvertebrates and phytobenthos. For certain sub-types, other aspects of water quality, such as suspended sediment and minerals, should be considered.

Bowman (1996) concluded there had been a progressive deterioration of water quality in Lough Derg and its inflowing rivers, particularly after 1980. The rapid nutrient enrichment of the Shannon tributaries and ensuing impacts on those rivers and the lakes was noted as the greatest pressure on the Shannon system by Bowman (1998). The lower Shannon River was classified as moderate status by the EPA for the monitoring period 2007-2009, indicating that enrichment continues to be a problem for the river (McGarrigle et al., 2010). For the same period, the upper Shannon estuary was classified as good status, while the lower Shannon estuary, the Fergus, Maigue and Cashen (Feale) estuaries were all at moderate status (McGarrigle et al., 2010).

The target for water quality: nutrients is: The concentration of nutrients in the water column should be sufficiently low to prevent changes in species composition or habitat condition

4.3.1 *Groenlandia densa*, Opposite-leaved Pondweed

Groenlandia densa appears to be sensitive to eutrophication (Preston, 2003).

4.3.2 Bryophyte-rich streams and rivers

Bryophyte-rich streams and rivers are considered highly sensitive to nutrient enrichment and can also be impacted by increased sediment loads. This sub-type may require WFD high status in terms of nutrients, oxygen, macroinvertebrates and phytobenthos.

4.4 Vegetation composition: typical species

The sub-types of this habitat are poorly understood and their typical species have not yet been fully defined. Typical species and appropriate targets may emerge to be site-specific. The typical species may include higher plants, bryophytes, macroalgae and microalgae.

The target for vegetation composition: typical species is: Typical species of the relevant habitat sub-type should be present and in good condition

4.4.1 *Groenlandia densa*, Opposite-leaved Pondweed

The species has been associated with *Zannichellia palustris* L., *Callitriche* sp., *Persicaria hydropiper* (L.) Spach and *Schoenoplectus triqueter* in the River Shannon (NPWS Rare and Threatened Plant Species Database, Reynolds et al., 2006). In the Limerick Canal, *Groenlandia densa* is associated with *Myriophyllum verticillatum* L. and *Callitriche* spp., also *Sagittaria sagittifolia* L., charophytes, some *Nuphar lutea* (L.) Sm., *Potamogeton crispus* L., *P. natans* L. and fine-leaved *Potamogeton* spp. (Reynolds et al., 2006).

4.4.2 *Schoenoplectus triqueter*, Triangular Club-rush

The Triangular Club-rush tends to grow on bare mud with relatively few associated species, although it is known to be found with *Groenlandia densa* in the River Shannon (Preston and Croft, 2001, Rich and FitzGerald, 2002, Deegan and Harrington, 2004). It grows down-gradient from *Phragmites australis* (Cav.) Trin. ex Steud., *Schoenoplectus tabernaemontani* (C.C. Gmel.) Palla, *Bolboschoenus maritimus* (L.) Palla, closer to the water's edge (Preston and Croft, 2001, Rich and FitzGerald, 2002, Deegan and Harrington, 2004). Praeger (1934) noted these same associated species in the Shannon, and also recorded *Typha angustifolia* L., *Cochlearia anglica* L., *Rorippa sylvestris* (L.) Besser*, Eleocharis uniglumis* (Link) Schult., *Alisma plantago-aquatica* L.*, Apium nodiflorum* (L.) Lag.*, Persicaria amphibia* (L.) Gray and *Chara* sp. Deegan and Harrington (2004) recorded the following additional associated vascular plant species at several of its sites: *Aster tripolium* L., *Caltha palustris* L., *Agrostis stolonifera* L., *Persicaria hydropiper* (L.) Spach, *Senecio aquaticus* Hill, *Myosotis scorpioides* L. and *Ranunculus sceleratus* L. *Rumex crispus* subsp. *uliginosus* (Le Gall) Akeroyd is also a frequent associate [most, if not all, literature records for *Rumex hydrolapathum* Huds at *Schoenoplectus triqueter* sites are referable to this taxon (M. Wyse Jackson pers. comm.)]. The bryophyte, *Bryum marratti* Hook.f. & Wilson, may be associated with *Schoenoplectus triqueter*, as it is a species of un-shaded, mud or sand at the top edge of saltmarshes where there is some flushing with freshwater (N. Lockhart, pers. comm., Lockhart et al., 2012).

4.4.3 Bryophyte-rich streams and rivers

The typical bryophytes include the threatened *Schistidium platyphyllum* and *Philonotis caespitosa*, as well as *Platyhypnidium riparioides* (Hedw.) Dixon*, Sciuro-hypnum plumosum* (Hedw.) Ignatov & Huttunen*, Fontinalis antipyretica* and *Cinclidotis fontinaloides,* with occasional *Hygroamblystegium tenax* (Hedw.) Jenn.*, Aneura pinguis* (L.) Dumort. and *Fissidens crassipes* Wilson ex Bruch & Schimp. (Lockhart, 1992). *Ranunculus penicillatus* (Dumort.) Bab. is the most widespread associated vascular plant (Lockhart, 1992).

A bryophyte-dominated community was also recorded in the narrower (1-4 m wide) channels in the Mulkear system with *Platyhypnidium riparioides, Racomitrium affine* (F.Weber & D.Mohr) Lindb.*, Fontinalis antipyretica, Sciuro-hypnum plumosum, Chiloscyphus polyanthos* (L.) Dumort.*, Fissidens viridulus* (Sw. ex anon.) Wahlenb.*, Leptodictyum riparium* (Hedw.) Warnst. and *Trichostomum brachydontium* Bruch (Lockhart, 1992). *Scapania unudulata* (L.) Dumort. is also found in fast-flowing upland streams (Lockhart, 1992). Vascular plants are generally absent, apart from the ubiquitous *Ranunculus penicillatus* (Lockhart, 1992).

4.5 Floodplain connectivity

River connectivity with the floodplain is important for the functioning of this habitat. Channels with a naturally functioning floodplain are better able to maintain habitat and water quality (Hatton-Ellis and Grieve, 2003). Floodplain connectivity is particularly important in terms of sediment sorting and nutrient deposition. High-conservation-value rivers are intimately connected to floodplain habitats and function as important wildlife corridors, connecting otherwise isolated or fragmented habitats in the wider countryside (Hatton-Ellis and Grieve, 2003).

The target for floodplain connectivity is: The area of active floodplain at and upstream of the habitat should be maintained

4.6 Riparian Habitat

The target for riparian habitat is: The area of riparian woodland at and upstream of the bryophyte-rich sub-type should be maintained. See also the conservation objective for Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (Alno-Padion, Alnion incanae, Salicion albae)-91E0.

4.6.1 Bryophyte-rich streams and rivers

The Bilboa River is noted as having exceptionally fine stands of semi-natural broadleaf woodland along the river (Lockhart, 1992). The bryophyte flora of the Bilboa River requires conservation of this riparian woodland in order to maintain humid conditions, as well as to suppress competition from vascular plants and filamentous algae through shading.

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Appendix 1 Distribution map