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**KING'S ISLAND**  
FLOOD RELIEF SCHEME

## **NIS Addendum Report King's Island Flood Relief Scheme**

**October 2020**



Comhairle Cathrach  
& Contae **Luimnigh**

**Limerick City**  
& County Council



**OPW** Oifig na  
nOibreacha Poiblí  
Office of Public Works

## JBA Project Manager

Declan White  
24 Grove Island  
Corbally  
Limerick  
Ireland

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## Contract

This report is on behalf of Limerick City and County Council. This report provides an Addendum to the NIS for the King's Island Flood Relief Scheme.

Prepared by .....Patricia Byrne BSc (Hons) PhD MCIEEM  
Ecologist

Reviewed by .....Niamh Burke BSc PhD CEnv MCIEEM  
Principal Ecologist

.....Declan Egan BSc (Hons), MSc MCIWEM  
MCIWM C.WEM CSci CEnv

.....Technical Director Environment

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# 1 Introduction

Limerick City & County Council (LCCC) submitted a planning application to An Bord Pleanála in December of 2019 for a flood relief Scheme (FRS) for King's Island, Limerick City. This application was submitted under Part 8 and Foreshore Act, and included submission of an Environmental Impact Assessment Report (EIAR) (JBA, 2019a) and a Natura Impact Statement (NIS) (JBA, 2019b) in respect of the proposed development.

Following a call for public submissions, An Bord Pleanála issued a Further Information (FI) request in relation to the submitted EIAR and NIS reports. The FI requests are listed in full in Appendix A. Of the 12 points listed in the FI requests, two of them (points 7 (a) to (c), and point 8) relate to the NIS. These are listed in Section 1.1 below and are addressed in further sections of this report.

## 1.1 Comments received from An Bord Pleanála

### 7. Natura Impact Statement

#### 7(c) Screening out of Qualifying Interests in Lower River Shannon SAC

The RFI point 7(a) states: Screening out of Qualifying Interests in Lower River Shannon SAC

The NIS screens out the following qualifying interests:

- Sandbanks which are slightly covered by sea water all the time [1110]
- Coastal lagoons [1150]
- Large shallow inlets and bays [1160]
- Reefs [1170]
- Perennial vegetation of stony banks [1220]
- Vegetated sea cliffs of the Atlantic and Baltic coasts [1230]
- Salicornia and other annuals colonising mud and sand [1310]
- Atlantic salt meadows (*Glauco-Puccinellietalia maritima*) [1330]
- Mediterranean salt meadows (*Juncetalia maritimi*) [1410]
- Water courses of plain to montane levels with the *Ranunculus fluitantis* and *Callitriche-Batrachion* vegetation [3260]
- *Molinia* meadows on calcareous, peaty or clayey-silt-laden soils (*Molinia caerulea*) [6410]
- *Margaritifera margaritifera* (Freshwater Pearl Mussel) [1029]
- *Tursiops truncatus* (Common Bottlenose Dolphin) [1349]

*It states that such screening out is based on the ecological surveys and data sources referenced however no detail of same is provided and the ecology baseline included in Chapter 3 of the NIS does not reference any of the aforementioned qualifying interests. Therefore you are requested to provide a detailed rationale for screening out the aforementioned qualifying interests. You are advised that particular attention should be given to 'Water courses of plain to montane levels with the *Ranunculus fluitantis* and *Callitriche-Batrachion* vegetation [3260]'.*

*This information can be submitted by way of either a revised NIS or an addendum to the current NIS.'*

**The above concerns have been addressed in Section 2 of this report**

#### 7(b) In-combination Effects

RFI point 7(b) states that: *'Further information is required regarding the potential in-combination effects with other plans and projects to clearly demonstrate no risk of adverse effects on the integrity of any European site. The reliance on the absence of in-combination effects on the basis that such effects would have been considered during the environmental and planning process of*



*an extant development. Where such cumulative effects are discounted, no evidence has been presented as to whether the other plans or projects considered the proposed development in their assessment of in-combination effects.*

*Furthermore, statements that it is not possible to state in known detail whether a planned development will present cumulative impacts in combination with the proposed development is not considered satisfactory.*

*You are advised that it is the proposed development that needs to address the in-combination effects with the other plans or projects.*

*You are therefore requested to provide a comprehensive consideration of in-combination effects with other plans and projects as is required by Article 6(3) of the Habitats Directive.*

*You are also advised that there are numerous references within Chapter 6 of the NIS to “no detailed assessment of likely cumulative impacts can be assessed as part of the EIAR for this project”. Furthermore, the description of the Limerick Distributor Road refers to Phase 1 being 450m northwest of Kings Island and elsewhere states that Phase 1 is not located near the River Shannon which requires clarification.*

*This information can be submitted by way of either a revised NIS or an addendum to the current NIS.'*

**The above concerns have been addressed in Section 3 of this report**

#### **7(c) Upgrading of existing pathway**

*The RFI Point 7(c) states that: 'Section 7.2.1.1 of the NIS outlines potential sources of impact via surface water pathways. One such potential source is stated to be the laying of the macadam topped path to the north of the sheet piling (connecting the paved areas of path on the present eastern embankment with the paths on top of the new centre and western embankments) will require excavation of 50m length x 255mm depth x 2.4m width of soil prior to laying 200mm stone, with capping of Macadam.*

*Please clarify if the upgrading of the existing pathway to the northeast and east of the site linking into the proposed new embankment pathways comprises part of the proposed development or whether it is proposed to be undertaken as part of another phase/project.'*

**The above concerns have been addressed in Section 4 of this report**

#### **8. Bryophyte communities**

*The RFI Point 8 states: 'A number of submissions refer to the presence of bryophyte communities (mosses and lichens) associated with the qualifying interest 'watercourses of plain to montane levels' associated with the Lower River Shannon SAC on Quay walls within the application boundary. You are requested to respond to this matter.'*

**Information on the presence of Bryophyte communities has been included in Section 5 of this Addendum NIS report, as well as being addressed in the Addendum to the EIAR for King's Island FRS.**

## 2 Screening out of Qualifying Interests in Lower River Shannon SAC

This section outlines the response to the submissions on the screening of Qualifying interests of the Lower River Shannon SAC, and provides information on the screening out of Qualifying Interests in Lower River Shannon SAC [002165] that were not included in the original NIS.

**With regard to comment No. 7 (a):**

### **7(a). Screening out of Qualifying Interests in Lower River Shannon SAC**

*The NIS screens out the following qualifying interests:*

- *Sandbanks which are slightly covered by sea water all the time [1110]*
- *Coastal lagoons [1150]*
- *Large shallow inlets and bays [1160]*
- *Reefs [1170]*
- *Perennial vegetation of stony banks [1220]*
- *Vegetated sea cliffs of the Atlantic and Baltic coasts [1230]*
- *Salicornia and other annuals colonising mud and sand [1310]*
- *Atlantic salt meadows (*Glauco-Puccinellietalia maritima*) [1330]*
- *Mediterranean salt meadows (*Juncetalia maritimi*) [1410]*
- *Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation [3260]*
- *Molinia meadows on calcareous, peaty or clayey-silt-laden soils (*Molinion caeruleae*) [6410]*
- *Margaritifera margaritifera (Freshwater Pearl Mussel) [1029]*
- *Tursiops truncatus (Common Bottlenose Dolphin) [1349]*

*It states that such screening out is based on the ecological surveys and data sources referenced however no detail of same is provided and the ecology baseline included in Chapter 3 of the NIS does not reference any of the aforementioned qualifying interests. Therefore you are requested to provide a detailed rationale for screening out the aforementioned qualifying interests. You are advised that particular attention should be given to 'Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation [3260]'.*

As a background information to this section the project zone of influence (Section 2.1 below) and description of Lower River Shannon SAC (002165) (Section 2.2 and 2.2.1 below) have been extracted from the NIS and copied below.

### **2.1 Project Zone of Influence (Section 2.5 of original NIS)**

As the FRS works are confined to King's Island and will largely use existing infrastructure, the project will primarily affect the area of site construction works within King's Island only. However, due to the proximity to the River Shannon and, Lower River Shannon SAC, a 2km distance for surface water impacts on any supporting habitats and species has been considered as stated in Section 2.5 of the original NIS (JBA 2019a).

### **2.2 Lower River Shannon SAC (002165) (Section 5.2 of original NIS)**

The Lower River Shannon SAC is an extensive Special Area of Conservation (SAC) encompassing the Rivers Shannon, Feale, Mulkear and Fergus. The River Shannon within this SAC flows through Carboniferous limestone as far as Foynes town and west of Foynes, through mostly Namurian shales and flagstones. The section of the River Shannon which is adjacent to the proposed development site, is part of the Shannon Estuary and so is influenced by the tides. Salinity levels vary throughout the estuary (NPWS, 2013). Saltmarsh and mud flat habitats are present along the estuary, with specialised colonisers of mud dominating areas between the two

habitats. There are 10 different benthic community types recorded within this SAC two of which are within the zone of influence of the proposed development site including (NPWS, 2012b):

- Intertidal sand to mixed sediment with polychaetes, molluscs and crustaceans community complex
- Estuarine subtidal muddy sand to mixed sediment with gammarids community complex

The Shannon Estuary provides support to large numbers of wintering water birds, including some Annex I species including Great Northern Diver, Whooper Swan, Pale-bellied Brent Goose, Golden Plover and Bar-tailed Godwit. Otter has been commonly found in the River Shannon, as have Salmon and Lamprey (NPWS, 2013).

Several Irish Red Data Book species have been recorded within this SAC including (but not limited to) Triangular Club-rush (*Scirpus triquetrus*) and Opposite-leaved Pondweed (*Groenlandia densa*). Triangular Club-rush is a rare and highly threatened vascular plant in Ireland with restricted distribution to tidal stretches of the River Shannon. It is protected under the Wildlife Acts (1976 and 2000) and is listed on the Flora Protection order 2015. Opposite-leaved Pondweed is typically associated in Ireland with tidal stretches of rivers or disturbed watercourses. It is protected under the Wildlife Acts (1976 and 2000) and is listed on the Flora Protection Order 2015 (NPWS, 2012b). Locations where Opposite-leaved Pondweed and Triangular Club-rush are present on this site are classified as sub-types of the Annex I habitat Water courses of plain to montane levels with the *Ranunculion fluitans* and *Callitriche-Batrachion* vegetation (3260).

### 2.2.1 Qualifying Interests (Section 5.2.1 of original NIS)

The site is a SAC selected for the following habitats and/or species listed on Annex I / II of the E.U. Habitats Directive (\* = priority; numbers in brackets are Natura 2000 codes):

- Sandbanks which are slightly covered by sea water all the time [1110]
- Estuaries [1130]
- Mudflats and sandflats not covered by seawater at low tide [1140]
- Coastal lagoons [1150]
- Large shallow inlets and bays [1160]
- Reefs [1170]
- Perennial vegetation of stony banks [1220]
- Vegetated sea cliffs of the Atlantic and Baltic coasts [1230]
- Salicornia and other annuals colonising mud and sand [1310]
- Atlantic salt meadows (*Glaucopuccinellietalia maritima*) [1330]
- Mediterranean salt meadows (*Juncetalia maritimi*) [1410]
- Water courses of plain to montane levels with the *Ranunculion fluitans* and *Callitriche-Batrachion* vegetation [3260]
- Molinia meadows on calcareous, peaty or clayey-silt-laden soils (*Molinion caeruleae*) [6410]
- Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (*Alno-Padion*, *Alnion incanae*, *Salicion albae*) [91E0]
- *Margaritifera margaritifera* (Freshwater Pearl Mussel) [1029]
- *Petromyzon marinus* (Sea Lamprey) [1095]
- *Lampetra planeri* (Brook Lamprey) [1096]
- *Lampetra fluviatilis* (River Lamprey) [1099]
- *Salmo salar* (Salmon) [1106]
- *Tursiops truncatus* (Common Bottlenose Dolphin) [1349]
- *Lutra lutra* (Otter) [1355]

**The following text was provided in the original NIS, under Section 5.2.1. Qualifying Interests**

*Not all the qualifying features of the SAC occur in the Zone of Influence of the proposed project at King's Island, based on the ecological surveys and data sources referenced in the above sections, and therefore only the relevant features are considered in this assessment.*

**The above paragraph is to be removed from the NIS and replaced with the further information provided below in Section 2.3 of this Addendum.**

**2.3 Screening of QI of Lower River Shannon SAC (002165)**

The following habitats were assessed as not being impacted by the King's Island FRS works.

- Sandbanks which are slightly covered by sea water all the time [1110]
- Large shallow inlets and bays [1160]
- Reefs [1170]
- Coastal lagoons [1150]
- Perennial vegetation of stony banks [1220]
- Vegetated sea cliffs of the Atlantic and Baltic coasts [1230]
- Salicornia and other annuals colonising mud and sand [1310]
- Atlantic salt meadows (*Glauco-Puccinellietalia maritima*) [1330]
- Mediterranean salt meadows (*Juncetalia maritimi*) [1410]
- Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitriche-Batrachion* vegetation [3260]
- *Molinia* meadows on calcareous, peaty or clayey-silt-laden soils (*Molinion caeruleae*) [6410]
- *Margaritifera margaritifera* (Freshwater Pearl Mussel) [1029]
- *Tursiops truncatus* (Common Bottlenose Dolphin) [1349]

The QI for Lower River Shannon SAC listed above are considered in detail and assessed for screening below. The Conservation Objectives of each habitat and Maps of their distribution within Lower River Shannon SAC are shown in Appendices B.1 to B.23.

**2.3.1 Sandbanks which are slightly covered by sea water all the time [1110]**

The conservation objectives for Sandbanks which are slightly covered by sea water all the time and a map of the distribution of this habitat within Lower River Shannon are seen in Appendix B.1 and B.2.

There is surface water connectivity between the proposed site at King's Island and the Sandbanks habitat. The sandbanks are located at the mouth of the River Shannon approx. 80km from King's Island. However, it is assessed that due to the scale and temporary nature of the FRS works, the distance from the King's Island site, and dilution by the large volume of marine water within the Shannon Estuary, there will be no significant impacts on this habitat from the proposed works, therefore this habitat is screened out.

**2.3.2 Large shallow inlets and bays [1160]**

The habitat Large shallow inlets and bays may also partially incorporate Mudflats and sandflats not covered by water at low tide, Sandbanks which are slightly covered by sea water all the time [1110] and Reefs.

The Conservation Objectives for Large shallow inlets and bays and a map of the distribution of this habitat within Lower River Shannon SAC are shown in Appendix B.3 and B.4.

Large shallow inlets and bays habitat within Lower River Shannon SAC are located in the outer part of the estuary/bay over 40km downstream of King's Island and it is assessed that due to the scale and temporary nature of the FRS works and distance from the King's Island site, and dilution by the large volume of marine water within the Shannon Estuary, there will be no significant impacts on this habitat from the proposed works, therefore this habitat is screened out.



### 2.3.3 Reefs [1170]

The conservation objectives for Reefs and a map of their distribution within Lower River Shannon SAC are shown in Appendix B.5 and B.6

The nearest mapped reef habitat are located approximately 15km downstream of King's Island and it is assessed that due to the scale and temporary nature of the FRS works and distance from the King's Island site, and dilution by the large volume of marine water within the Shannon Estuary, there will be no significant impacts on this habitat from the proposed works, therefore this habitat is screened out.

### 2.3.4 Coastal lagoons [1150]

The conservation objectives for Coastal lagoons and a map of their distribution within Lower River Shannon SAC are shown in Appendix B.7 and B.8.

Coastal lagoons are present in the outer areas of Shannon Estuary, with the nearest one to King's Island located at Shannon Airport over 20km away via open water. Though these lagoons are under the influence of seawater percolating to them by way of seepage through cobble banks, it is assessed that the surface water pathway to them is indirect, and that due to the scale and temporary nature of the FRS works, distance of the lagoons from the King's Island site, and dilution by the large volume of marine water within the Shannon Estuary, there will be no significant impacts on this habitat from the proposed works, therefore this habitat is screened out.

### 2.3.5 Perennial vegetation of stony banks [1220]

The conservation objectives for Perennial vegetation of stony banks and a map of their distribution within Lower River Shannon SAC are shown in Appendix B.9 and B.11.

Perennial vegetation of stony banks are located in the outer reaches of the Shannon Estuary, over 60km from King's Island and it is assessed that due to the scale and temporary nature of the FRS works and distance from the King's Island site, and dilution by the large volume of marine water within the Shannon Estuary, there will be no significant impacts on this habitat from the proposed works, therefore this habitat is screened out.

### 2.3.6 Vegetated sea cliffs of the Atlantic and Baltic coasts [1230]

The conservation objectives for Vegetated sea cliffs of the Atlantic and Baltic coasts and a map of their distribution within Lower River Shannon SAC can be seen in Appendix B.11 and B.12

Vegetated sea cliffs of the Atlantic and Baltic coasts are located in the outer reaches of the Shannon Estuary, over 70km from King's Island. It is assessed that as there is no connectivity between the FRS works and this terrestrial habitat, there will be no significant impacts on this habitat from the proposed works, therefore this habitat is screened out.

### 2.3.7 Salicornia and other annuals colonising mud and sand [1310]

The conservation objectives for Salicornia and other annuals colonising mud and sand and a map of their distribution within Lower River Shannon SAC are seen in Appendix B.13 and B.14.

Salicornia and other annuals colonising mud and sand are located in several areas in the middle and outer reaches of the Shannon Estuary, tens of km from King's Island.

Any temporary resuspension of sediment into the water column during a short period of the tidal cycle while the works take place, will not have a significant impact on the *Salicornia* habitat area. Estuaries are dynamic environments and the variable movement of large volumes of suspended particles are part of their natural processes.

It is assessed that due to the scale and temporary nature of the FRS works and distance from the King's Island site, and dilution by the large volume of marine water within the Shannon Estuary, there will be no significant impacts on this habitat from the proposed works, therefore this habitat is screened out.

### 2.3.8 Atlantic salt meadows (*Glauco-Puccinellietalia maritima*) [1330]

The conservation objectives of Atlantic salt meadows (*Glauco-Puccinellietalia maritima*) within Lower River Shannon SAC are seen in Appendix B.15 and a map of their distribution on Appendix B.15 and B.14.

Atlantic salt meadows are located in several areas in the middle and outer reaches of the Shannon Estuary, over 14km from King's Island.

Any temporary resuspension of sediment into the water column during a short period of the tidal cycle while the works take place, will not have a significant impact on the Atlantic salt meadows habitat area. Estuaries are dynamic environments and the variable movement of large volumes of suspended particles are part of their natural processes.

It is assessed that due to the scale and temporary nature of the FRS works and distance from the King's Island site, and dilution by the large volume of marine water within the Shannon Estuary, there will be no significant impacts on Atlantic salt meadows habitat from the proposed works, therefore this habitat is screened out.

### 2.3.9 Mediterranean salt meadows (*Juncetalia maritimi*) [1410]

The conservation objectives of Mediterranean salt meadows (*Juncetalia maritimi*) within Lower River Shannon SAC are shown in Appendix B.16 and a map of their distribution in Appendix B.16 and B.14.

Mediterranean salt meadows are located in several areas in the middle and outer reaches of the Shannon Estuary, over 35km from King's Island.

Any temporary resuspension of sediment into the water column during a short period of the tidal cycle while the works take place, will not have a significant impact on the Mediterranean salt meadows habitat area. Estuaries are dynamic environments and the variable movement of large volumes of suspended particles are part of their natural processes.

It is assessed that due to the scale and temporary nature of the FRS works and distance from the King's Island site, and dilution by the large volume of marine water within the Shannon Estuary, there will be no significant impacts on Mediterranean salt meadows habitat from the proposed works, therefore this habitat is screened out.

### 2.3.10 Water courses of plain to montane levels with the *Ranunculon fluitantis* and *Callitricho-Batrachion* vegetation [3260]

As required by FI request 7 (a) the following rationale for the screening-out of the above QI, is set out in further detail:

Three sub-types of the habitat '*Water courses of plain to montane levels with the Ranunculon fluitantis and Callitricho-Batrachion vegetation*' are known to occur in the Lower River Shannon SAC. These include the following:

1. *Groenlandia densa* (L.) Fourn., 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 (NPWS, 2012a). The conservation objectives of Water courses of plain to montane levels with the *Ranunculon fluitantis* and *Callitricho-Batrachion* and a map of their distribution within Lower River Shannon SAC are shown in Appendix B.17 and B.18.

#### 2.3.10.1 Opposite-leaved Pondweed

Opposite-leaved Pondweed is recorded as occurring in the City Canal, to the east of King's Island. However, there is no connectivity via watercourse between King's Island and the canal, as the canal flows into the Abbey River. Opposite-leaved Pondweed was found in a drainage ditch at the north west of King's Island during JBA ecological surveys (2017) for the King's Island FRS. However the habitat was assessed as not being of sufficient quality to be classified as the Annex 1 habitat Water courses of plain to montane levels with the *Ranunculon fluitantis* and *Callitricho-Batrachion* vegetation [3260] (Denyer, 2017). As this population of Opposite-leaved pondweed lies outside the SAC, it is being separately covered and assessed within the EIAR Biodiversity Chapter 8 and Addendum EIAR (Section 4) for King's Island FRS.

For the purposes of the NIS, it is therefore considered that there will be no significant impacts on the habitat sub-type Opposite-leaved Pondweed in the Lower River Shannon SAC due to the proposed works; therefore this habitat is screened out.

#### 2.3.10.2 Schoenoplectus triqueter (L.) Palla, Triangular Club-rush

*Schoenoplectus triqueter* (L.) Palla, Triangular Club-rush was previously recorded on the north west riverbank of King's Island and 1 km further downstream on the right-hand bank of the estuary (NPWS, 2012). It was not recorded on the north west banks of King's island during the present surveys for the King's Island FRS though there could potentially be a seed bank within the sediment. This species requires fine substrata and maintenance of appropriate hydrological and tidal regimes. Salinity appears to be the most important factor limiting the downstream extension of *S. triqueter* in the main estuary (Deegan and Harrington 2004).

As the works will not be interfering with the hydrological and tidal regimes of the estuary due to the scale and temporary nature of the FRS works, it is assessed that there will be no significant impacts on this habitat from the proposed works, therefore this habitat sub-type is screened out.

#### 2.3.10.3 Bryophyte-rich streams and rivers

Bryophyte-rich streams and rivers habitat is recorded in fast flowing rivers and streams (NPWS, 2012) within Shannon estuary SAC. However, the river section adjacent to King's Island is a lowland depositing river, and does not have the high, variable, flow or structure (in-channel and marginal cobbles and boulders) of bryophyte dominant upland eroding rivers. Although the quay walls along the southern boundary of the King's Island do support a vascular plant and bryophyte flora, the habitat in this area would not be expected to support the protected assemblage referred to in this QI.

A survey was carried out during July 2020 (see Denyer Ecology 2020 and Appendix C) to ascertain the assemblage present on the quay walls. No rare or protected bryophyte species were recorded during this survey. Although it is noted that full access to the full extent of the wall was not possible, the aquatic bryophyte assemblage found was characterized by *Cinclidotus fontinaloides* (locally abundant), *Fontinaloides antipyretica* (locally abundant), *Platyhypnidium plumosum* and *Sciurohypnum plumosum*.

It is thus concluded that the rare/ protected bryophyte species recorded from within the Lower River Shannon SAC (and which indicate the 'bryophyte-rich sub-type') are highly unlikely to occur within this habitat. Bryophytes are of low cover in the overall channel as they are restricted to the quay walls. Therefore, the aquatic bryophyte zone is not considered to be an example of the Annex I habitat 3260. However, it does have affinity with this habitat, is part of an SAC river system (for which 3260 is a Qualifying Interest) and functions as an ecological link/ corridor through the city in this part of the SAC and has County level ecological value.

It is therefore assessed that as the Annex I habitat 3260 sub-type Bryophyte-rich streams and rivers habitat does not occur within the zone of influence of the King's Island FRS, there will be no significant impacts on this habitat from the proposed works, therefore this habitat sub-type is screened out.

The full report on Bryophyte-rich streams and rivers habitat on the Limerick city quay walls (Denyer 2020) can be seen in Appendix C of this report. Section 5 of this report also addresses the presence of bryophyte communities (mosses and lichens) associated with the qualifying interest 'watercourses of plain to montane levels' associated with the Lower River Shannon SAC on Quay walls within the application boundary, as per RFI Point 8.

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

The conservation objectives for Molinia meadows on calcareous, peaty or clayey-silt-laden soils for the Lower River Shannon SAC are seen in Appendix B.19. This habitat has been recorded on the eastern bank of the Shannon, just north of Castleconnell, Co. Limerick. This is a terrestrial grassland habitat, and as there is no connectivity between this habitat and the proposed FRS site at King's Island, it is therefore assessed that there will be no significant impacts on Molinia meadows in the Lower River Shannon SAC from the proposed works; therefore this habitat is screened out.

### 2.3.12 *Margaritifera margaritifera* (Freshwater Pearl Mussel) [1029]

The conservation objectives for Freshwater Pearl Mussel and a map of their distribution within Lower River Shannon SAC are seen in Appendix B.20 and B.21.

NPWS (2012e) identifies that the Freshwater Pearl Mussel population in the Lower River Shannon SAC are located within the Cloon River catchment (Co. Clare). This is within a separate sub-catchment and over 40km from King's Island. There is therefore no pathway of effect between the location of Freshwater Pearl Mussel within the Lower Shannon SAC and the proposed FRS site on King's Island. It is therefore assessed that there will be no significant impacts on Freshwater Pearl Mussel in the Lower River Shannon SAC from the proposed works, therefore this species is screened out.

### 2.3.13 *Tursiops truncatus* (Common Bottlenose Dolphin) [1349]

The conservation objectives for Common Bottlenose Dolphin and a map of their preferred distribution within Lower River Shannon SAC are shown in Appendix B.22 and B.23. As seen in the map and supported by more recent data (Rogan et al. 2018), the critical habitats for Common Bottlenose Dolphin are in the middle and outer Shannon Estuary SAC. It is assessed that due to the scale and temporary nature of the FRS works and dilution by the large volume of marine water within the Shannon Estuary, there will be no significant impacts on this species from the proposed works, therefore this species is screened out.

### 3 Cumulative and In-combination Effects

This section provides further information and consideration of cumulative and in-combination effects of other plans and projects relevant to the proposed development, in response to the following comments:

**With regard to comment No. 7 (b):**

#### **7(b). In-combination Effects**

*'Further information is required regarding the potential in-combination effects with other plans and projects to clearly demonstrate no risk of adverse effects on the integrity of any European site. The reliance on the absence of in-combination effects on the basis that such effects would have been considered during the environmental and planning process of an extant development. Where such cumulative effects are discounted, no evidence has been presented as to whether the other plans or projects considered the proposed development in their assessment of in-combination effects. Furthermore, statements that it is not possible to state in known detail whether a planned development will present cumulative impacts in combination with the proposed development is not considered satisfactory.*

*You are advised that it is the proposed development that needs to address the in-combination effects with the other plans or projects.*

*You are therefore requested to provide a comprehensive consideration of in-combination effects with other plans and projects as is required by Article 6(3) of the Habitats Directive.*

*You are also advised that there are numerous references within Chapter 6 of the NIS to "no detailed assessment of likely cumulative impacts can be assessed as part of the EIAR for this project". Furthermore, the description of the Limerick Distributor Road refers to Phase 1 being 450m northwest of Kings Island and elsewhere states that Phase 1 is not located near the River Shannon which requires clarification.*

#### **3.1 Cumulative and In-combination Effects**

The following sections are to replace the original text of Chapter 6 Other Relevant Plans and Projects of the King's Island FRS NIS in response to RFI 7(b).

##### **3.1.1 Cumulative Effects (to replace Section 6.1 in original NIS)**

The King's Island site is situated in an island location surrounded by watercourses and connected by bridges to Limerick city. The Limerick City Development Plan zones this area for nature, amenity, residential and commercial use with existing facilities located within the housing estates to the north and commercial/historic areas to the south.

There are likely to be many applications for development within and adjacent to Limerick city in the future. Cumulative Impacts are those which result from incremental changes caused by other past, present or reasonably foreseeable developments together with the Flood Relief Scheme. Cumulative impacts were assessed by looking at all previous developments and current developments for which planning has been received within 10km of the proposed site location. A consideration of development objectives in the current development plans in the area was also carried out. This cumulative assessment has considered cumulative impacts that are:

- (a) Likely;
- (b) Significant; and
- (c) Relating to an event which has either occurred or is reasonably foreseeable together with the impacts from this development.

A search in relation to plans and projects that may have the potential to result in cumulative impacts was carried out. JBA reviewed Limerick County Councils planning files to determine grant of planning for developments/schemes close to the King's Island FRS. We found that seven projects that have been granted planning may have the potential for cumulative impacts with the King's Island Flood Relief Scheme.



These seven projects/schemes are listed below.

- Killaloe Bypass/ Shannon Bridge Crossing and R494 Improvement Scheme
- Limerick Northern Distributor Road
- Opera Site, Limerick City
- Limerick Urban Centre Revitalisation - O'Connell Street
- Mungret Local Infrastructure Housing- Phase 1
- International Rugby Experience Building, O'Connell Street
- Orchard Housing Development, King's Island

The potential cumulative impacts of these schemes on the two Natura 2000 sites Lower River Shannon SAC and River Shannon and River Fergus Estuaries SPA is summarised below. JBA has assessed only the cumulative impact of developments that have been granted planning. If the construction periods of these developments are to overlap, there is the potential to impact on Lower River Shannon SAC through reduced surface water quality. These effects will be temporary.

### 3.1.2 Killaloe Bypass/Shannon Bridge Crossing and R494 Improvement Scheme

The proposed Killaloe Bypass, Shannon Bridge Crossing and R494 Improvement Scheme, Co. Clare will provide a western bypass of Killaloe, a new bridge crossing of the River Shannon and an upgrade of the existing R494 regional road from Ballina to the N7 at Birdhill. The proposed site is located approximately 16.5km north-east of the King's Island FRS site. The proposed bypass, bridge and road improvements have been subject to NIS and EIS which was approved by An Bord Pleanála. Construction of this project has yet to commence. The Tender Prior Information Notice (PIN) was published in December 2019 with the scheme expected to go to tender in September 2020. Following the procurement process and evaluation of tenders received, it is expected to award the contract in 2021 subject to Department approval. The construction period is expected to take 3 years thereafter.

The impact of the proposed scheme on the ecological environment along the proposed route will be locally significant for the River Shannon and associated habitats where the new Shannon Bridge crossing will be located. However, with mitigation described in the NIS and EIA, the ecological integrity of the Lower River Shannon SAC will not be adversely affected (Roughan & O'Donovan Consulting Engineers, Clare County Council/North Tipperary County Council (2012).

Due to the temporary nature of the works, the mitigation measures included in the NIS and EIA for the road developments, the distance (>25km north of King's island) from the present project and the dilution effect of the Shannon River, it is therefore anticipated that the proposed Killaloe Bypass/Shannon Bridge Crossing and R494 Improvement Scheme **will not have any significant cumulative impacts** with the King's Island FRS in relation to the Lower River Shannon SAC and River Fergus Estuaries SPA.

### 3.1.3 Limerick Northern Distributor Road (LNDR)- Phase 1

Limerick Northern Distributor Road (LNDR) scheme will comprise of the design and construction of approximately 10km of a northern distributor road that will include a crossing of the Ardnacrusha Tailrace and the River Shannon, with possible crossings of the Blackwater and Mulkear Rivers. The proposed scheme will provide a northern distributor road around Limerick City, improving accessibility to the city from County Clare and relieving pressure on the existing river crossings in the City Centre.

Phase 1 of the LNDR is between Coonagh Roundabout and Knockalisheen Road, to the north-west of King's Island FRS. Coonagh Roundabout is located approx. 1.8km north of the Shannon Estuary, and over 2km to the west of King's Island .This is a correction from the distance given in the original NIS, and addresses the point in the ABP FI request.

The construction site for the dual carriageway will go from Coonagh Roundabout in a north easterly direction as far as Knockalisheen Roundabout on the Knockalisheen Road. The proposed Knockalisheen Roundabout is approx. 2km from the Shannon River and King's Island. The final phase of this road's construction is scheduled to commence in September 2020. The development works, which includes the construction of a 2.2km dual carriageway with three new roundabouts, footways, cycle ways, verges and two railway over bridges, is a key element of the Limerick Regeneration programme.

After being subjected to the environmental and planning process Phase 1 (Coonagh - Knockalisheen) of the scheme has commenced construction and is expected to be completed before Kings Island is constructed (commencement expected September 2020).

The EIAR for the project lists mitigation measures for the control of surface water drainage from the road during construction. Surface water runoff from the road during operation will discharge to Shannon Estuary via storage areas and a network of watercourses and culverts. Pollution control will be implemented through the provision of petrol interceptors. The EIAR for the road scheme provides for mitigation measures to control dust and air emissions arising during construction of the roads.

With mitigation measures for Phase 1 of the project listed in the EIAR, it is therefore anticipated that Phase 1 of the project will **not have any significant cumulative impacts** with the King's Island Flood Relief Scheme in relation to the Lower River Shannon SAC and River Fergus Estuaries SPA from either surface water emissions or air emissions.

Clare County Council, in conjunction with Limerick City and County Council, has commenced the planning process to advance the development of Phase 2 of the Limerick Northern Distributor Road and associated infrastructure from a location in the vicinity of the eastern end of the proposed Coonagh-Knockalisheen Strategic Route to tie-in with the R445 (Old N7) in County Limerick stage (Limerick County Council, 2020). Any proposed cumulative impacts of Phase 2 cannot be assessed until final route selection and detailed design is available.

### 3.1.4 Opera Site, Limerick City

**An Bord Pleanála Order Reference No:** ABP-304028-19

**Date Granted:** 27/02/2020

The proposed regeneration of the Opera Site as part of the Limerick Twenty Thirty includes a mixed-use development, comprising of offices, retail, culture, licenced premises and other ancillary uses. The Opera site is located approximately 50m south of the King's Island site boundary. The potential cumulative impacts of the Opera site development and the King's Island FRS that may arise are:

- Increased surface water runoff during construction and operation.
- Increase in air pollutants during construction and operation.

For the Opera Site, construction access will occur from R445 and Michael Street minimising the impact on more sensitive roads around the site (AECOM, 2019, EIAR Chapter 13: Traffic & Transport). The assessment concludes that there will be a negligible effect on local traffic, pedestrian and cycle delay and public transport. The EIAR conducted for the Kings Island FRS has included mitigation measures to control traffic generated during the construction of the scheme. The construction footprint for Kings Island FRS will allow construction traffic to use a variety of travel routes. This will, by default, minimise the combined traffic volumes generated by both projects during construction.

The separation of the construction traffic for the projects will have the effect of minimising the cumulative increases in ambient noise levels during construction. Noise and vibration-based impacts were also assessed for the Opera Site and concluded that there would be no significant impacts. Chapter 9 of the EIAR for the Opera Site.

The cumulative impacts of both developments on air quality and climate Assessment, has also outlined that during construction a series of best practice measures will be adopted to limit the generation of dust to protect residential properties in the vicinity of the site.

Chapter 16 Biodiversity, of the EIAR for the Opera Site, highlights only a small number of residual impacts of local significance post-mitigation, these include disturbance to and loss of nesting sites (house sparrow, lesser black-backed gull, starling, swift; and herring gull); disturbance to and loss of roost site – Bats (non-breeding Common Pipistrelle); and the permanent loss of foraging habitat in unlit site interior - Bats (Foraging Leisler's bat, Common Pipistrelle bat, Soprano Pipistrelle bat).

In the absence of mitigation, the main cumulative impacts from the Opera project during construction and the King's Island FRS are The installation of a new outfall to the Abbey River (in Charlotte's Quay, adjacent the Lower River Shannon SAC) to service a new surface water sewer. During construction, there is potential for dust, silt, oils, fluids, paints, and/or concrete washings, etc. to temporarily enter the Abbey River and impact water quality and aquatic species

However, the Construction Methodology and Phasing Management Plan (CMPP) for the Opera site includes pollution and spill control measures which will mitigate against any of these potential impacts. These include a Mobile Elevated Working Platform (MEWP), parked on Charlotte's Quay, which will allow Contractors to access the limestone wall from the Abbey River side of the existing quay wall, whilst avoiding instream works. The Contractors will use a coring method (i.e. drilling from north to south), which will avoid any material entering the Abbey River. This will avoid any disturbance to bryophyte communities located c.1 m below the proposed outfall location. There will be no pouring of concrete for the installation of the proposed outfall, albeit Contractors will be permitted to locally grout the finished outfall. An Ecological clerk of works (EcOW) will review and input to the method statement produced by the Contractor to ensure the method statement contains the specific measures above. The EcOW or other similarly experienced ecologist will then supervise the works to Charlotte Quay and direct or advise the Contractor as appropriate, to ensure the method statement is implemented, and bryophyte communities and water quality of the Lower River Shannon SAC are protected (AECOM, 2019).

During operation, no cumulative impacts are predicted, taking into account the following design mitigation (AECOM, 2019):

- The SUDS system included in the design of the new surface water sewer which will remove silt from roof and pedestrianised hardstanding run-off, prior to run-off entering the Abbey River within the Lower River Shannon SAC; and
- The proposed diversion of surface water from basement carparking areas (which will be contaminated with elevated levels of detergents in contrast to roof and pedestrianised hardstanding run-off) into an existing combined sewer, which will carry this contaminated surface water to the existing licensed Bunlicky Waste Water Treatment Plant (WwTP) for treatment prior to discharge to the Lower River Shannon SAC.
- Confirmation from Irish Water that the load generated by the proposed development can be catered for. Potential pollution impacts from the discharge of treated effluent in the River Shannon, following treatment at Bunlicky WwTP are therefore considered non-significant.

The Opera Site has been granted planning permission and the construction phase of the project is estimated at 4.5 to 6 years. Whilst the Opera site and King's Island FRS may overlap during the construction phases of both projects, with the mitigation measures upheld for the Opera Site EIAR and NIS and King's Island FRS EIAR and NIS, it anticipated that the proposed Opera Site development **will not have any significant cumulative impacts** with the King's Island FRS in relation to the Lower River Shannon SAC and River Fergus Estuaries SPA.

### 3.1.5 Limerick Urban Centre Revitalisation - O'Connell Street

**Planning application Reference No: 198006**

**Date Granted: 10/09/2019**

The Limerick Urban Centre Revitalisation - O'Connell Street, otherwise known as the LUCROC project, is a commitment to the revitalisation of O'Connell Street, which will result in quantifiable improvements to urban mobility and the urban environment. The project is will located between the junctions of Denmark Street and Barrington Street, approximately 786 metres in length. This proposed revitalisation projected is located approximately 330m south-west of the King's Island FRS site.

Planning for LUCROC project has been granted, and it is envisaged that the project will be constructed over the following two years, i.e. the construction period may overlap with the King's Island Flood Relief Scheme.

EIA Screening (ARUP, 2019a) and Screening for Appropriate Assessment (ARUP, 2019b) were carried out, and it was determined that a full Stage 2 Appropriate Assessment is not required in respect of this proposed development. It was assessed that cumulative effects are not predicted.

There will be no direct discharges to surface water during the construction phase of the LUCROC development. The likelihood that the release of contaminated surface water could cause a significant effect to the Lower River Shannon SAC is considered highly unlikely given the existing drainage network in place and the nature of the activities proposed.

Surface water run-off which is collected on site will be released via the existing network to a closed wastewater collection network which is treated in the Bunlicky WwTP prior to discharge to the Shannon estuary, in accordance with the EPA wastewater discharge licence. As such, the construction phase of the proposed development is not predicted to result in a significant negative effect on hydrology or surface water quality.

During the operational phase surface water run-off, will be released to the existing closed network which is treated in the Bunlicky WwTP prior to discharge to the Shannon estuary, in accordance with the EPA wastewater discharge licence (ARUP, 2019). As such, no significant negative effects on hydrology or surface water quality are envisaged during the operational phase of the proposed development.

It is therefore concluded that the proposed LUCROC project will **not have any significant cumulative impacts** with the King's Island Flood Relief Scheme in relation to the Lower River Shannon SAC and River Fergus Estuaries SPA

### 3.1.6 Mungret Local Infrastructure Housing and Infrastructure

The Mungret Local Infrastructure Housing, to the west of Limerick city, is one of the aspects of the Limerick Twenty Thirty plan, that includes the upgrading of roads to allow for the development of 450 homes by 2021, with a potential estimate of 2,700 homes to be provided on the lands (part of the Mungret-Loughmore Masterplan). The infrastructure will also ensure the delivery of a post primary school in the area within the next 3 years. The 200-unit first phase of the development is expected to be completed by end of 2021. The Mungret development is located approximately 5.5km south-west of the King's Island FRS site, off the N69.

Phase 1 of the development includes the Mungret Link Streets Project (Part VIII development) which creates the infrastructure necessary for further development. Limerick City & County Council carried out an Environmental Impact Assessment (EIA) Screening Report for the Mungret Link Streets Project in accordance with the requirements of Article 120(1B)(b)(i) and has determined that there is no real likelihood of significant effects on the environment. Accordingly, it has been determined that EIA is not required in respect of this proposed development.

Limerick City & County Council has also carried out an Appropriate Assessment (AA) Screening Report (Mott McDonald, 2019) and determined that a full Stage 2 Appropriate Assessment is not required in respect of this proposed development. The Appropriate Assessment Screening concluded that there is no potential for significant effects on the integrity of Natura 2000 sites within the potential Zone of Impact from the proposed development, either alone or in-combination with other plans and/or projects.

It is therefore anticipated that Phase 1 of the proposed Mungret Link Streets Project will **not have any significant cumulative impacts** with the King's Island Flood Relief Scheme in relation to the Lower River Shannon SAC and River Fergus Estuaries SPA.

### 3.1.7 International Rugby Experience Building, O'Connell Street

**ABP Planning Reference Number: 171180/ PL91 .301154**

**Date Granted: 14/02/2018**

The International Rugby Experience Building (extension) on O'Connell Street will comprise of the demolition of the ground floor at No. 42 O'Connell Street and the basement area at No. 42 O'Connell Street/No.1 Cecil Street comprising of retail premises (Fines Jewellers), and the construction of an extension to the 'International Rugby Experience' to incorporate the existing

retail floorspace at ground level and provide additional exhibition floorspace at basement level; all associated revisions to the O'Connell Street (west) elevation and Cecil Street (south) elevation of the 'International Rugby Experience'; minor revisions to fenestration at first floor level and second floor level. The site is located approximately 670m south-west of the proposed King's Island FRS site. The International Rugby Experience Building (extension) received Conditional Permission on 2nd of April 2019.

An EIA Screening and Screening for AA was carried out for this project, and the requirement to undertake a Stage 2 Appropriate Assessment was screened out, with no impact indicated for Natura 2000 sites.

Thus, due to the nature and location of the International Rugby Experience Building development in Limerick City, this project **will not have any significant cumulative impacts** with the King's Island Flood Relief Scheme in relation to the Lower River Shannon SAC and River Fergus Estuaries SPA.

### 3.1.8 Orchard Housing Development, King's Island

**Planning Application No: 198004**

**Date Granted: 2/10/2019**

A housing complex for elderly persons is proposed on King's Island, and was submitted as a Part 8 planning application to LCCC. The Orchard Housing Development was granted permission in 2019 subject to a number of planning conditions. The site is divided into two plots, known as the Orchard Site and the Garden Site, on either side of Old Dominick Street, comprising 27 residential units. The Orchard Site is at the location of the existing temporary car park for King John's Castle. The proposed FRS will be approximately 0.6ha and will also incorporate a pedestrian walkway and green space, and parking spaces to serve the housing units. The development will also involve the reduction of Old Dominick Street from a two-way street to a one-way street and widening of pedestrian pavement.

Limerick City and County Council carried out an Environmental Impact Assessment (EIA) Screening Report and AA Screening report and has determined that a full Appropriate Assessment is not required in respect of this proposed development, and that there is no likelihood of significant effects on the environment or Natura 2000 sites, including cumulative impacts from other plans and projects.

Thus, due to the nature and location of the Orchard Housing Development, King's Island, in Limerick City, this project **will not have any significant cumulative impacts** with the King's Island Flood Relief Scheme in relation to the Lower River Shannon SAC and River Fergus Estuaries SPA.

## 3.2 Summary Cumulative Effects (to replace Section 6.2 in original NIS)

Following review of existing and proposed projects and plans, **no significant cumulative and in-combination effects are predicted** for the proposed King's Island FRS to affect the Lower River Shannon SAC and River Shannon and River Fergus Estuaries SPA.



## 4 Upgrading of Existing Pathway

This section answers the query on the upgrading of pathway to the north and east of the site.

**With regard to comment No. 7 (c):**

### **7(c) Upgrading of existing pathway**

The RFI Point 7(c) states that: *'Section 7.2.1.1 of the NIS outlines potential sources of impact via surface water pathways. One such potential source is stated to be the laying of the macadam topped path to the north of the sheet piling (connecting the paved areas of path on the present eastern embankment with the paths on top of the new centre and western embankments) will require excavation of 50m length x 255mm depth x 2.4m width of soil prior to laying 200mm stone, with capping of Macadam.'*

*Please clarify if the upgrading of the existing pathway to the northeast and east of the site linking into the proposed new embankment pathways comprises part of the proposed development or whether it is proposed to be undertaken as part of another phase/project.'*

The existing pathway to the northeast and east of the site will remain in its existing condition, and does not comprise part of the proposed King's Island Flood Relief Scheme.

## 5 Bryophyte Communities

This section outlines the response to the submissions on the presence of bryophyte communities (mosses and lichens) associated with the qualifying interest 'Watercourses of plain to montane levels' associated with the Lower River Shannon SAC on Quay walls within the application boundary.

**With regard to comment No. 8:**

### **8. Bryophyte communities**

*A number of submissions refer to the presence of bryophyte communities (mosses and lichens) associated with the qualifying interest 'watercourses of plain to montane levels' associated with the Lower River Shannon SAC on Quay walls within the application boundary. You are requested to respond to this matter.*

As outlined in Section 2.3.10.3 *Bryophyte-rich streams and rivers* habitat is one of three subtypes of the habitat Water courses of plain to montane levels with the Ranunculion fluitantis and Callitriche-Batrachion vegetation, known to occur in the Lower River Shannon SAC.

Following the submissions on the presence of bryophyte communities, a detailed survey of the quay walls in the southern section of King's Island was undertaken by Denyer Ecology (Denyer Ecology 2020). The survey area included the quay wall along the southern boundary of King's Island and part of the eastern and western boundaries (see Figure 1.1 in Denyer, 2020 and Appendix C). The main elements of this report are summarised below, and the full report is provided in Appendix C of this report.

Bryophyte-rich streams and rivers habitat is recorded in fast flowing rivers and streams (NPWS, 2012) within the Lower River Shannon SAC. However, the river section adjacent to King's Island would be categorized as a lowland depositing river, and does not have the highly variable flow regime or in-stream structure (e.g.: in-channel and marginal cobbles and boulders) of bryophyte dominant upland eroding rivers. Although the quay walls along the southern boundary of the King's Island do support a vascular plant and bryophyte flora, the habitat in this area would not be expected to support the protected assemblage referred to in this QI. A survey was carried out during July 2020 (see Denyer Ecology 2020 and Appendix C) to ascertain the assemblage present on the quay walls. No rare or protected bryophyte species were recorded during this survey. Although it is noted that full access to the full extent of the wall was not possible, the aquatic bryophyte assemblage found was characterized by *Cinclidotus fontinaloides* (locally abundant), *Fontinaloides antipyretica* (locally abundant), *Platyhypnidium plumosum* and *Sciuro-hypnum plumosum*.

It is thus concluded that the rare/ protected bryophyte species recorded from within the Lower River Shannon SAC (and which indicate the 'bryophyte-rich sub-type') are highly unlikely to occur within this habitat. Bryophytes are of low cover in the overall channel as they are restricted to the quay walls. Therefore, the aquatic bryophyte zone is not considered to be an example of the Annex I habitat 3260.

However, it can be stated that the zone in question does have affinity with this protected habitat in that it is part of an SAC river system (for which 3260 is a Qualifying Interest) and functions as an ecological link/ corridor through the city in this part of the SAC and has been assessed as being of 'County' level ecological value. This element of the vascular plant and bryophyte flora of the quay walls of County ecological value is dealt with in Section 4 of the addendum EIAR which includes mitigation measures for proposed works on the quay walls.

## 6 Section 2.4.7 Sub-area Construction Requirements

The following wording (2nd last paragraph) from sub-section heading **B3 Construction Requirements** in Section **2.4.7 Sub-area Construction Requirements** of the original NIS will be replaced:

**'Between the Courthouse and King John's Castle**

Past the courthouse, 6no. early mature Lime trees between the Council offices and the glass panelling will be removed for construction and replaced with appropriate species on completion of the construction works.'

Replacement text is as follows:

**'Between the Courthouse and King John's Castle**

Past the courthouse, 6no. early mature Lime trees between the Council offices and the glass panelling will be removed for construction.'

The removal and non-replacement of these trees will have no impact on the outcome of the NIS.

## References

- AECOM 2019. Environmental Impact Assessment Report Mixed Use Development - Opera Site, Limerick City and County Council. Available at: [https://www.limerick.ie/sites/default/files/media/documents/2019-03/Opera\\_Site\\_Environmental\\_Impact\\_Assessment\\_Report.pdf](https://www.limerick.ie/sites/default/files/media/documents/2019-03/Opera_Site_Environmental_Impact_Assessment_Report.pdf) [Accessed August 2019]
- ARUP, 2019a, Limerick City and County Council. Limerick Urban Centre Revitalisation - O'Connell Street Project. Report for the Purposes of Appropriate Assessment Screening. Available at: <http://eplan.limerick.ie/iDocsWebDPSS/ViewFiles.aspx?docid=1211838&format=jpeg> [Accessed 5 October 2020]
- ARUP, 2019b, Limerick City and County Council. Limerick Urban Centre Revitalisation - O'Connell Street Project. Report for the EIA Screening. Available at: <http://eplan.limerick.ie/iDocsWebDPSS/ViewFiles.aspx?docid=1211839&format=jpeg> [Accessed 5 October 2020]
- Barron, S.J.; Delaney, A.; Perrin, P.M.; Martin, J.; O'Neill, F. (2011). National survey and assessment of the conservation status of Irish sea cliffs. Irish Wildlife Manual No. 53
- Deegan, B.M. and Harrington, T.J. (2004) The distribution and ecology of *Schoenoplectus triqueter* in the Shannon Estuary. *Biology and Environment-Proceedings of the Royal Irish Academy*, 104B (2):107-117
- Denyer Ecology (2020). King's Island Quay Wall Bryophyte Assessment. Unpublished report for JBA Consulting
- JBA (2019a) King's Island Flood Relief Scheme - Environmental Impact Assessment Report. Unpublished report
- JBA (2019b) King's Island Flood Relief Scheme - Natura Impact Statement. Unpublished report.
- Limerick County Council (2020). Limerick North Distributor Road. Available at: <https://www.limerick.ie/council/services/roads-and-travel/road-improvements-major-schemes/limerick-northern-distributor> [Accessed 5 October 2020]
- McCorry, M. and Ryle, T (2009) Saltmarsh Monitoring Report 2007-2008: Unpublished Report to NPWS.
- Mott McDonald (2019) Mungret Link Streets Project Screening for Appropriate Assessment (2019) <https://mypoint.limerick.ie/en/system/files/materials/456/AA%20Screening%20Report.pdf>
- NPWS, (2012a) Conservation Objectives supporting document Water courses of plain to montane levels with the *Ranunculus fluitans* and *Callitriche-Batrachion* vegetation (habitat code 3260). Available at: [https://www.npws.ie/sites/default/files/publications/pdf/002165\\_Lower%20River%20Shannon%20SAC%20Water%20Courses%20Supporting%20Doc\\_V1.pdf](https://www.npws.ie/sites/default/files/publications/pdf/002165_Lower%20River%20Shannon%20SAC%20Water%20Courses%20Supporting%20Doc_V1.pdf) [Accessed 15 September 2020]
- NPWS (2012b). Conservation Objectives: Lower River Shannon SAC (site code 002165). Version 1.0. National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht. [online] [https://www.npws.ie/sites/default/files/protected-sites/conservation\\_objectives/CO002165.pdf](https://www.npws.ie/sites/default/files/protected-sites/conservation_objectives/CO002165.pdf) [accessed 24 April 2019]
- NPWS (2013). Site Synopsis: Lower River Shannon SAC 002165. National Parks and Wildlife Service / Department of Arts, Heritage and the Gaeltacht. [online] <https://www.npws.ie/sites/default/files/protected-sites/synopsis/SY002165.pdf>. [Accessed 5 April 2019]
- Rogan, E.; Garagouni, M.; M. Nykänen, M.; Whitaker, A.; Ingram, S.N. (2018) Bottlenose dolphin survey in the Lower River Shannon SAC, 2018. Unpublished report. Available at [https://www.npws.ie/sites/default/files/publications/pdf/Bottlenose%20dolphin%20survey%20in%20the%20Lower%20River%20Shannon%20SAC%202018\\_Final.pdf](https://www.npws.ie/sites/default/files/publications/pdf/Bottlenose%20dolphin%20survey%20in%20the%20Lower%20River%20Shannon%20SAC%202018_Final.pdf) [Accessed 5 October 2020]

## Appendices

### A Comments received from An Bord Pleanála

#### 1. Directive 2014/52/EU

The constraints study detailed in Section 3.1 of the EIAR states that same was undertaken by reference to the EPA's Guidelines 'Advice Notes on the current practice in the preparation of Environmental Impact Statements, 2003. Following the changes provided by Directive 2014/52/EU and in advance of its transposition by the European Union (Planning and Development) (Environmental Impact Assessment) Regulations 2018, the Environmental Protection Agency published Guidelines on the Information to be contained in Environmental Impact Assessment Reports (Draft August 2017).

While still in draft the Guidelines reflect the revisions in the Directive including the changes within the environmental factors to be addressed and are used as best practice. Whilst it is noted that the Guidelines are referenced at Section 1.3.1 of the EIAR, you are requested to review the EIAR in light of the changes provided for in Directive 2014/52/EU as transposed by the European Union (Planning and Development) (Environmental Impact Assessment) Regulations 2018 and reflected within the EPA's most recent guidance.

**This comment is addressed in EIAR Addendum Report**

#### 2. Environmental Factors – Land

The European Union (Planning and Development) (Environmental Impact Assessment) Regulations 2018 transpose the requirements of Directive 2014/52/EU into Irish planning law and by so doing amend Section 171A of the Planning and Development Act 2000, as amended. Section 171A(b)(i) requires "an examination, analysis and evaluation, carried out by the planning authority or the Board, as the case may be, in accordance with this Part and regulations made thereunder, that identifies, describes and assesses, in an appropriate manner, in the light of each individual case, the direct and indirect significant effects of the proposed development on the following:

- (I) population and human health;
- (II) biodiversity with particular attention to species and habitats protected under the Habitats and the Birds Directive;
- (III) land, soil, water, air and climate;
- (IV) material assets, cultural heritage and the landscape;
- (V) the interaction between the factors mentioned in clauses (I) to (V)"

You are requested to submit a revised Environmental Impact Assessment Report which includes an additional chapter which specifically address the matter of 'land' as it is included in Clause (III) above.

**This comment is addressed in EIAR Addendum Report**

#### 3. Mitigation measures

The Guidelines on the Information to be Contained in Environmental Impact Assessment Reports (Environmental Protection Agency, Draft August 2017) state at Section 3.8.4 that all commitments made within the EIAR by way of mitigation and monitoring need to be clear and specific.

It is stated: 'For ease of reference and clarity and to facilitate enforcement, all such measures contained in an EIAR can be included in a compendium of mitigation and monitoring commitments (only). This may be a separate section or Appendix to the EIAR. Such a compendium should comprise a list of relevant measures but should not elaborate on the reasoning or expected effectiveness of those measures as the elaboration will take place within



the main body of the EIAR'. You are requested to submit a revised Environmental Impact Assessment Report which includes either an additional chapter addressing this matter or provide an Appendix with the compendium of mitigation and monitoring commitments.

**This comment is addressed in EIAR Addendum Report**

#### **4. Cultural Heritage**

You are referred to the comments received from the Department of Culture, Heritage and the Gaeltacht relating to underwater archaeology. You are requested to address the concerns raised and in particular the following:

(i) Underwater AIA was recommended by NMS as part of consultation process for EIAR which has not been carried out but a recommendation for same included in the EIAR. It is stated that the full nature and extent of impacts arising on intertidal zones of the Abbey River and Shannon River for storage tanks, outfalls and spud leg barges are not fully detailed but potential for underwater cultural heritage to be present in areas not previously excavated are extremely high and it is again recommended that an UAIA be carried out as soon as possible to inform final design phase of works with part of Project Archaeologist role to advise on UAIA strategy.

(ii) In relation to Flood Cell Areas A5 & A6 it is stated that these areas are of high archaeological potential with Athlunkard directly linked with the Viking origins of Limerick with potential that sites or material relating to maritime activity including Athlunkard as a longphort with potential for remains of wrecks, nausts etc. to be present and original Viking settlement could be located within footprint of proposed works with similar potential for features of the walled city and its history. Recommendations proposed relate to the strategy for archaeology testing in areas that can be tested in advance of construction works. They also request that further information is required on outfalls proposed into Abbey River in terms of potential impacts on intertidal zone/Abbey River – the nature and extent of works. You are requested to address this matter.

(iii) Reference is also made to the works within Flood Cell Areas A9, A10, B1, B2 and B3 and in particular the potential for negative impacts on underwater cultural heritage from outfall works that may run into the intertidal zone or into the river within these areas and proposed intertidal works for the storage tanks and other works in the foreshore including use of spud leg barges and outfalls including one near King John's Castle with area to be impacted in foreshore and subtidal areas in Area B3.

(iv) It is stated that the proposed excavations for support walls behind historical quays will be deep with high potential to impact previously unrecorded archaeology.

- You are therefore requested to address the concerns expressed and to provide the further information requested and to outline the strategy proposed for the UAIA including scope and extent of the proposed assessment.
- You are also requested to review and revise the 'Proposed Testing Regime' outlined in Appendix G of Volume 2 of the EIAR which currently refers only to Flood Cell B3 to reflect the matters outlined within this request.

**This comment is addressed in EIAR Addendum Report**

#### **5. EIAR – Policy Consideration**

The policy section of the EIAR (section 2.5) does not reference the National Climate Action Plan 2019 which was published in August 2019 prior to the submission of the application. You are requested to revise this section of the EIAR to address all current policy provisions at National, Regional and Local level which relate to the proposed development.

**This comment is addressed in EIAR Addendum Report**

## 6. Japanese Knotweed Bund and Illegal Landfill

Reference is made in Chapter 10 (Soils and Geology) to excavation within Flood Cell A4 of contaminated soils on the site of the illegal landfill and to the excavation and movement of part of the Japanese Knotweed bund.

(i) In relation to the Japanese knotweed bund, it is noted that the development description provided in the planning report refers to replacing the excavated material on top of the existing bund (not within the SAC) and reprofiling same. However, section 2.4.7 of the NIS refers to the north-western section of the bund being relocated to the south-east of the bund to allow space for embankment construction. Furthermore, Section 11.4.2 of the EIA refers to the potential construction phase Noise and Vibration Impacts and refers in the description of Area A4 to the 'possible retaining wall construction at bund encapsulating Japanese Knotweed'. Please clarify and provide details of the proposed works including plans, elevations and sections of same

(ii) Please submit the Invasive Species Management Plan referenced in Section 8.2.2 of the EIA referenced in footnote 45 as an unpublished report prepared by JBA in 2019.

(iii) No detail is provided as to the removal of contaminated soils on the site of the illegal landfill. You are therefore requested to provide more detail on the current proposals for or remediation already carried out of same.

**This comment is addressed in EIA Addendum Report**

## 7. Natura Impact Statement

(a) Screening out of Qualifying Interests in Lower River Shannon SAC

The NIS screens out the following qualifying interests:

- Sandbanks which are slightly covered by sea water all the time [1110]
- Coastal lagoons [1150]
- Large shallow inlets and bays [1160]
- Reefs [1170]
- Perennial vegetation of stony banks [1220]
- Vegetated sea cliffs of the Atlantic and Baltic coasts [1230]
- Salicornia and other annuals colonising mud and sand [1310]
- Atlantic salt meadows (*Glauco-Puccinellietalia maritima*) [1330]
- Mediterranean salt meadows (*Juncetalia maritimi*) [1410]
- Water courses of plain to montane levels with the *Ranunculus fluitantis* and *Callitriche-Batrachion* vegetation [3260]
- *Molinia* meadows on calcareous, peaty or clayey-silt-laden soils (*Molinion caeruleae*) [6410]
- *Margaritifera margaritifera* (Freshwater Pearl Mussel) [1029]
- *Tursiops truncatus* (Common Bottlenose Dolphin) [1349]

It states that such screening out is based on the ecological surveys and data sources referenced however no detail of same is provided and the ecology baseline included in Chapter 3 of the NIS does not reference any of the aforementioned qualifying interests. Therefore you are requested to provide a detailed rationale for screening out the aforementioned qualifying interests. You are advised that particular attention should be given to 'Water courses of plain to montane levels with the *Ranunculus fluitantis* and *Callitriche-Batrachion* vegetation [3260]'.

This information can be submitted by way of either a revised NIS or an addendum to the current NIS

(b) In-combination Effects

Further information is required regarding the potential in-combination effects with other plans and projects to clearly demonstrate no risk of adverse effects on the integrity of any European site. The reliance on the absence of in-combination effects on the basis that such effects would have been considered during the environmental and planning process of an extant development. Where such cumulative effects are discounted, no evidence has been presented as to whether the other plans or projects considered the proposed development in their assessment of in-combination effects. Furthermore, statements that it is not possible to state in known detail whether a planned development will present cumulative impacts in combination with the proposed development is not considered satisfactory.

You are advised that it is the proposed development that needs to address the in-combination effects with the other plans or projects.

You are therefore requested to provide a comprehensive consideration of in-combination effects with other plans and projects as is required by Article 6(3) of the Habitats Directive.

You are also advised that there are numerous references within Chapter 6 of the NIS to “no detailed assessment of likely cumulative impacts can be assessed as part of the EIAR for this project”. Furthermore, the description of the Limerick Distributor Road refers to Phase 1 being 450m northwest of Kings Island and elsewhere states that Phase 1 is not located near the River Shannon which requires clarification.

This information can be submitted by way of either a revised NIS or an addendum to the current NIS.

#### (c) Upgrading of existing pathway

Section 7.2.1.1 of the NIS outlines potential sources of impact via surface water pathways. One such potential source is stated to be the laying of the macadam topped path to the north of the sheet piling (connecting the paved areas of path on the present eastern embankment with the paths on top of the new centre and western embankments) will require excavation of 50m length x 255mm depth x 2.4m width of soil prior to laying 200mm stone, with capping of Macadam.

Please clarify if the upgrading of the existing pathway to the northeast and east of the site linking into the proposed new embankment pathways comprises part of the proposed development or whether it is proposed to be undertaken as part of another phase/project.

**The above issues relating to Screening out of Qualifying Interests of the Lower River Shannon SAC, In-combination Effects, and upgrading of existing pathways, have been addressed in this Addendum NIS Report.**

### 8. Bryophyte communities

A number of submissions refer to the presence of bryophyte communities (mosses and lichens) associated with the qualifying interest ‘watercourses of plain to montane levels’ associated with the Lower River Shannon SAC on Quay walls within the application boundary. You are requested to respond to this matter.

**Information on the presence of bryophyte communities has been included in this Addendum NIS report as well as addressed in Section 4 of the Addendum EIAR report.**

### 9. Irish Water

The Board have received a submission from Irish Water and you are requested to address the matters raised as follows:

- Surface water drainage proposals include surface water connections and overflows to the Irish Water public foul network. It is Irish Water’s policy not to accept surface water or storm water run-off into its network and current proposals are unacceptable to Irish Water. The applicant is required to engage with Irish Water in respect of alternative proposals.

- Irish Water record indicate the presence of water/waste infrastructure which may be impacted by the proposed development with further information required as follows:
- Applicant shall submit a division enquiry to IW as a significant number of water mains and foul sewers will be impacts by the proposed works and all necessary measures to protect and maintain access to IW infrastructure should be undertaken.
- Applicant shall submit a pre-connection enquiry to IW to assess feasibility in respect of water and/or waste-water connections for Athlunkard Boat Club.

**This comment is addressed in EIAR Addendum Report**

#### **10. Curraghbour Boat Club**

It is proposed within Flood Cell B3 to construct an automatic flood gate at the entrance to Curragour Boat Club between the quay wall and the Potato Market boundary wall. You are requested to respond to the concerns expressed in the submission received from the Curragour Boat Club in respect of the proposed works.

**This comment is addressed in EIAR Addendum Report**

#### **11. Noise and Vibration**

Reference is made at Section 11.4.2 of the EIAR to a boardwalk over the SAC within Area A5 – Star Rovers to Athlunkard Boat Club – please clarify what is meant by boardwalk and if it is intended to provide same please provide comprehensive details of the proposal.

**This comment is addressed in EIAR Addendum Report**

#### **12. Linear Areas**

Please provide the linear area of each flood cell.

**This comment is addressed in EIAR Addendum Report**

## B Conservation Objectives and Maps for Annex 1 Habitats

### B.1 Conservation Objectives: Sandbanks which are slightly covered by sea water all the time

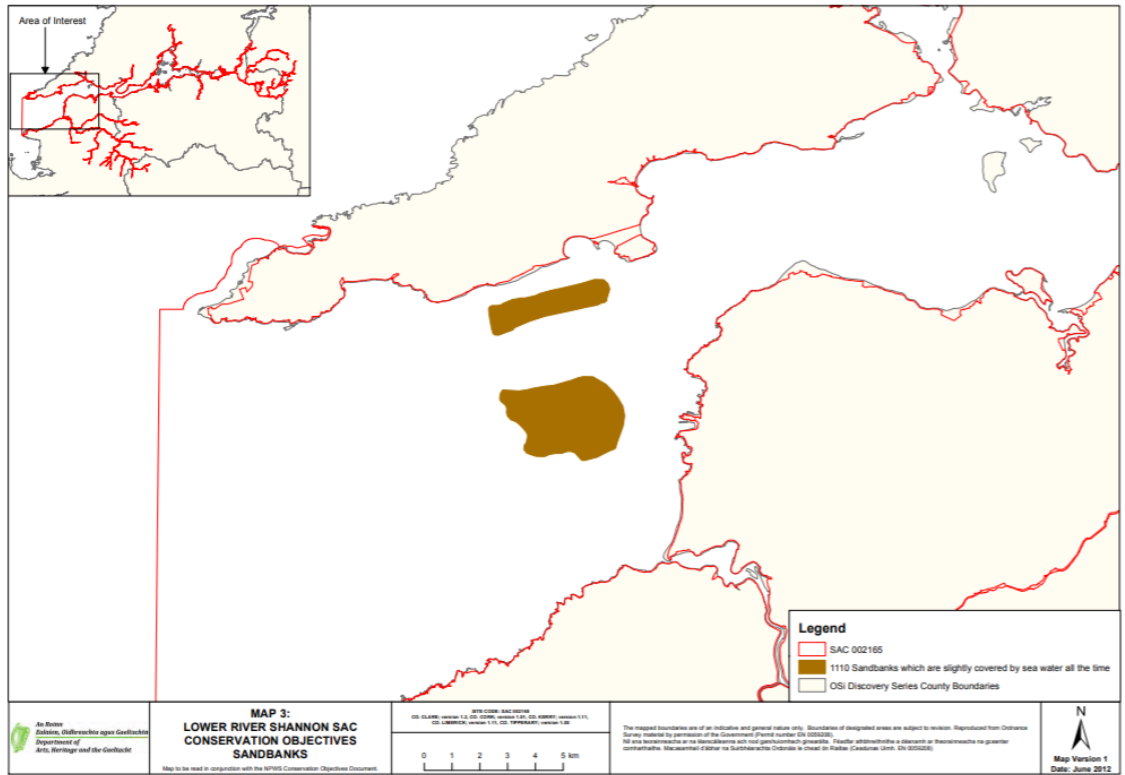
**1110 Sandbanks which are slightly covered by sea water all the time**

To maintain the favourable conservation condition of Sandbanks which are slightly covered by sea water all the time in the Lower River Shannon SAC, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Habitat distribution	Occurrence	The distribution of sandbanks is stable, subject to natural processes	
Habitat area	Hectares	The permanent habitat area is stable or increasing, subject to natural processes.	Habitat area was estimated as 1,353ha using the Valentia Island to River Shannon Admiralty Chart (no. 1819_0)
Community distribution	Hectares	Conserve the following community type in a natural condition: Subtidal sand to mixed sediment with Nephtys spp. community complex	-



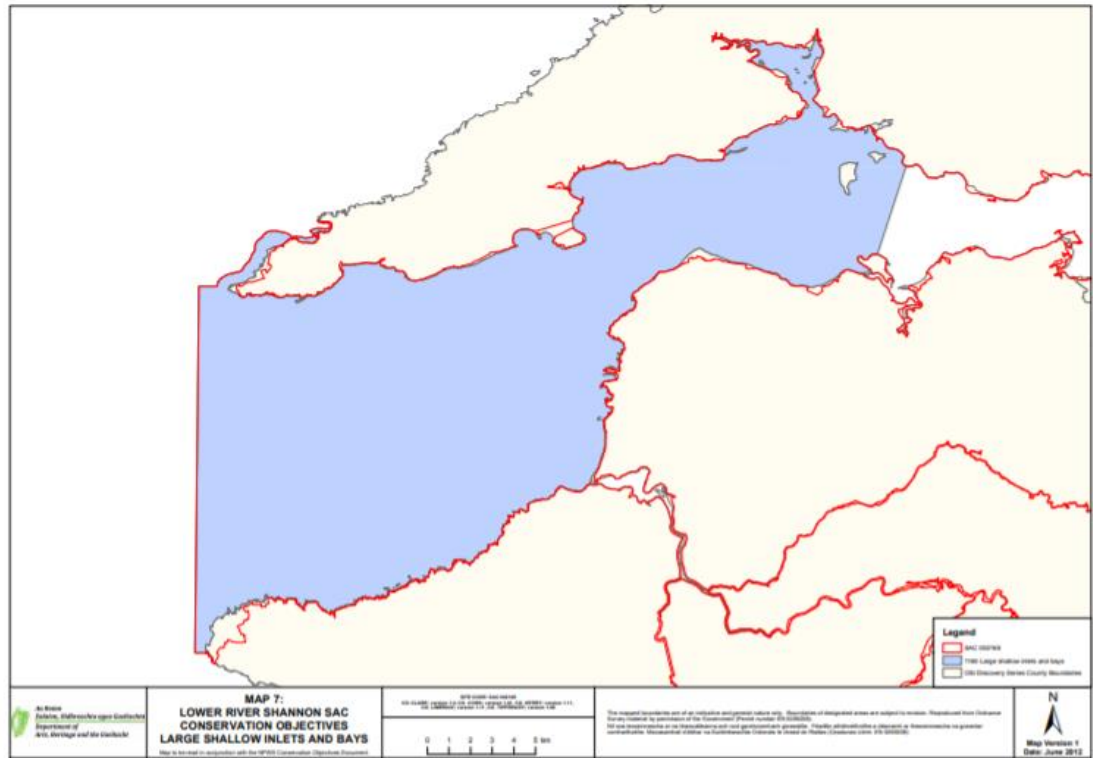
**B.2 Map: Lower River Shannon SAC - Sandbanks which are slightly covered by sea water all the time**



## B.3 Conservation Objectives: Large shallow inlets and bays

Conservation objectives for: Lower River Shannon SAC [002165] 1160 Large shallow inlets and bays To maintain the favourable conservation condition of Large shallow inlets and bays in the Lower River Shannon SAC, which is defined by the following list of attributes and targets:			
Attribute	Measure	Target	Notes
Habitat area	Hectares	The permanent habitat area is stable or increasing, subject to natural processes.	Habitat area was estimated as 35,282ha using OSi data and the Transitional Water Body area as defined under the Water Framework Directive
Community distribution	Hectares	Conserve the following community types in a natural condition: Intertidal sand with <i>Scolelepis squamata</i> and <i>Pontocrates</i> spp. community; Intertidal sand to mixed sediment with polychaetes, molluscs and crustaceans community complex; Subtidal sand to mixed sediment with <i>Nucula nucleus</i> community complex; Subtidal sand to mixed sediment with <i>Nephtys</i> spp. community complex; Fucoid-dominated intertidal reef community complex; Mixed subtidal reef community complex; Faunal turf-dominated subtidal reef community; Anemone-dominated subtidal reef community; and Laminaria-dominated community complex	-

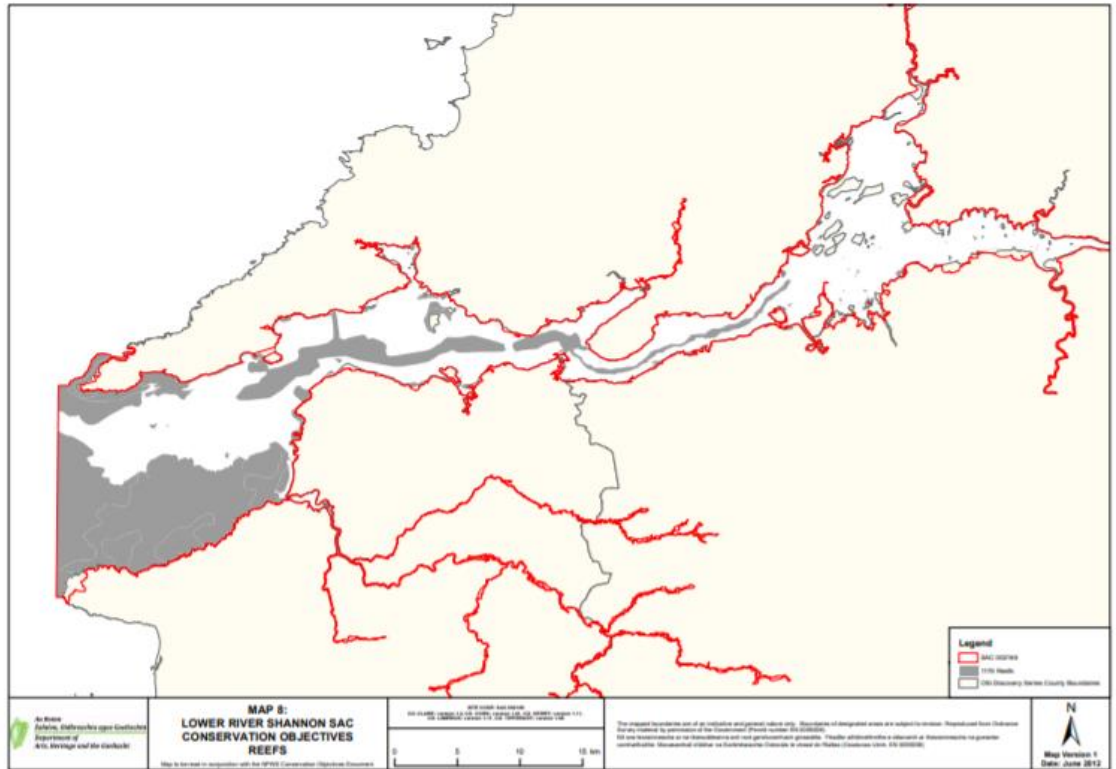
B.4 Map: Lower River Shannon SAC- Large shallow inlets and bays



## B.5 Conservation Objectives: Reefs [1170]

1170 Reefs To maintain the favourable conservation condition of Reefs in the Lower River Shannon SAC, which is defined by the following list of attributes and targets:			
Attribute	Measure	Target	Notes
Habitat distribution	Occurrence	The distribution of Reefs is stable, subject to natural processes.	
Habitat area	Hectares	The permanent habitat area is stable or increasing, subject to natural processes.	Habitat area was estimated as 21,421ha from the 2010 intertidal and subtidal reef survey
Community distribution	Hectares	Conserve the following reef community types in a natural condition: Furoid-dominated intertidal reef community complex; Mixed subtidal reef community complex; Faunal turf-dominated subtidal reef community; Anemone-dominated subtidal reef community; and Laminaria-dominated community complex. S	-

B.6 Map: Lower River Shannon SAC- Reefs

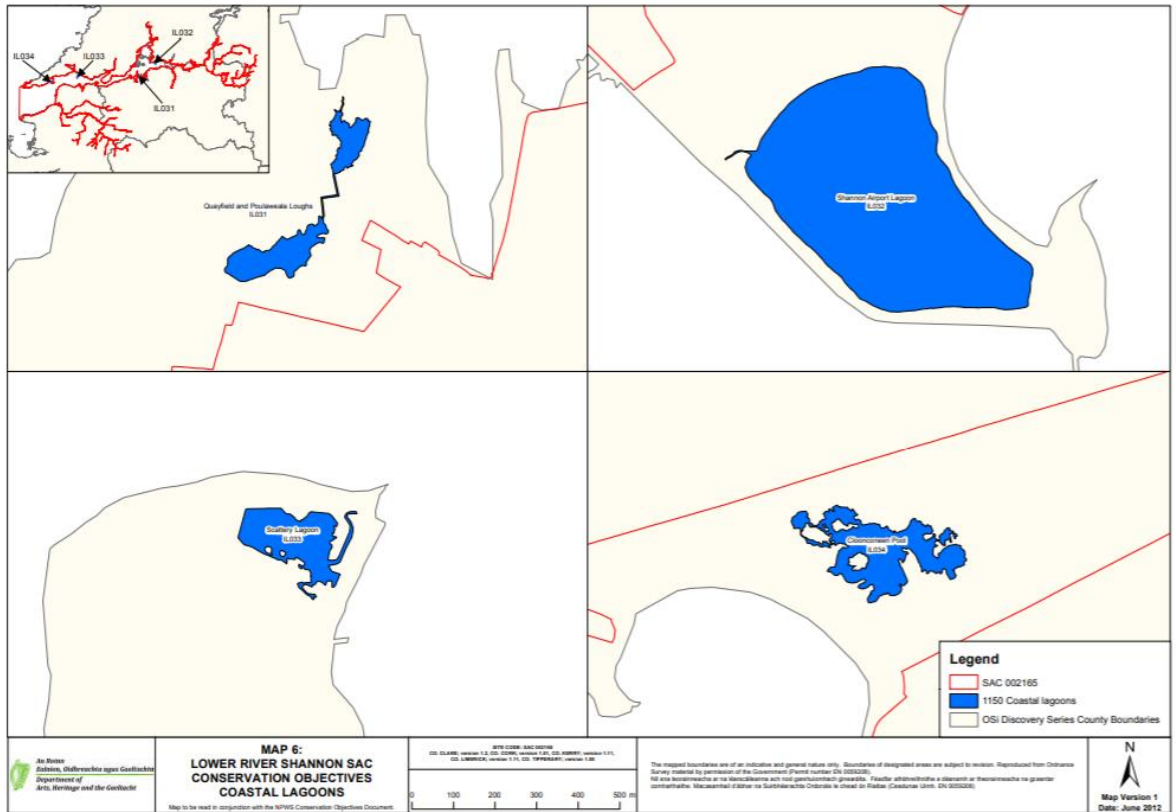




## B.7 Conservation Objectives: Coastal lagoons

1150 *Coastal lagoons To restore the favourable conservation condition of Coastal lagoons in the Lower River Shannon 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, Favourable reference area 33.4ha- Shannon Airport Lagoon 24.2ha; Cloonconeen Pool 3.9ha; Scatterry Lagoon 2.8ha; Quayfield and Poulaweala Loughs 2.5ha.	Areas calculated from spatial data derived from Oliver, 2007. S
Habitat distribution	Occurrence	No decline, subject to natural processes	
Salinity regime	practical salinity units (psu)	Median annual salinity and temporal variation within natural ranges	The lagoons in the site vary from oligohaline to euhaline affected by the construction of navigation walls and dredging of the main channel
Hydrological regime	Metres	Annual water level fluctuations and minima within natural ranges	Lagoons listed for this site are all considered to be shallow
Barrier: connectivity between lagoon and sea	Permeability	Appropriate hydrological connections between lagoons and sea, including where necessary, appropriate management	The lagoons within this site exhibit a variety of barrier types including cobble/shingle, karst and artificial embankment.
Water quality: chlorophyll a	µg/L	Annual median chlorophyll a within natural ranges and less than 5µg/L	
Water quality: Molybdate Reactive Phosphorus (MRP)	mg/L	Annual median MRP within natural ranges and less than 0.1mg/L	
Water quality: Dissolved Inorganic Nitrogen (DIN)	mg/L	Annual median DIN within natural ranges and less than 0.15mg/L	-
Depth of macrophyte colonisation	Metres	Macrophyte colonisation to maximum depth of lagoons	-As these lagoons are all shallow, it is expected the macrophytes should extend to their deepest points
Typical plant species	number and m <sup>2</sup>	Maintain number and extent of listed lagoonal specialists, subject to natural variation	
Typical animal species	number	Maintain listed lagoon specialists, subject to natural variation	
Negative indicator species	Number and % cover	Negative indicator species absent or under control	Low salinity, shallow water and elevated nutrient levels increase the threat of unnatural encroachment by reedbeds

## B.8 Map: Lower River Shannon SAC- Coastal lagoons

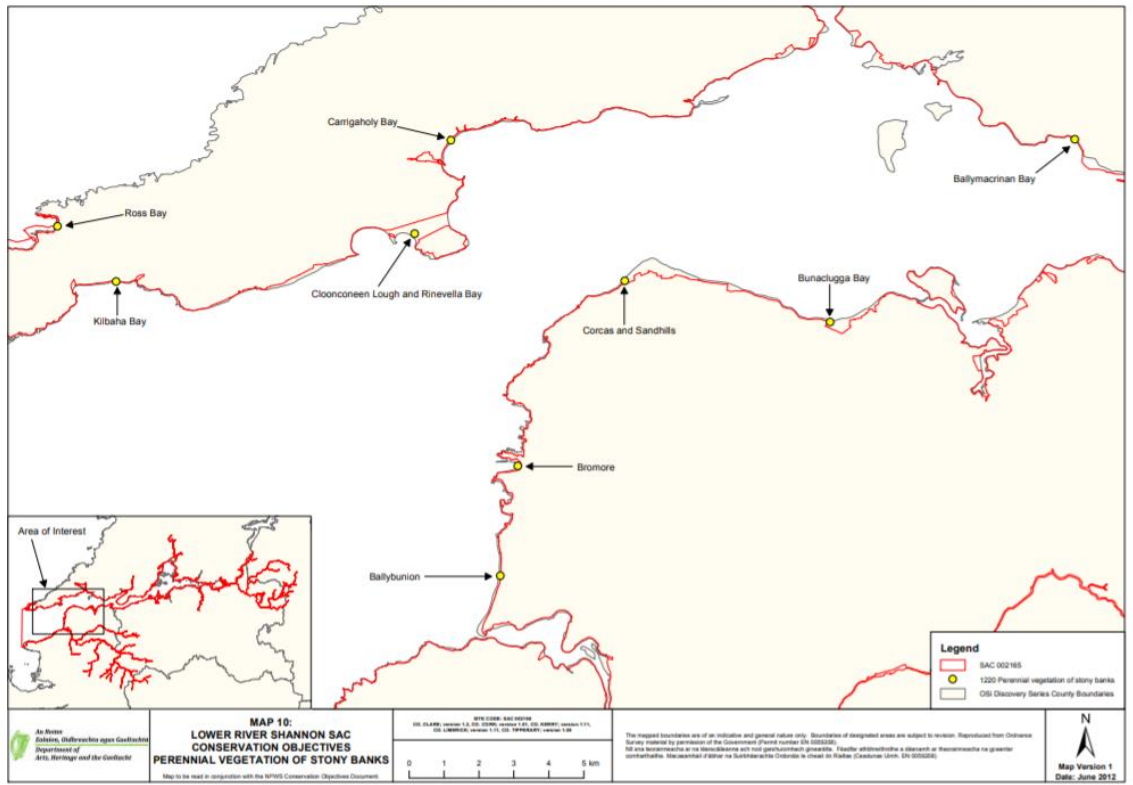


## B.9 Conservation Objectives: Perennial vegetation of stony banks [1220]

1220 Perennial vegetation of stony banks			
To maintain the favourable conservation condition of Perennial vegetation of stony banks in the Lower River Shannon SAC, which is defined by the following list of attributes and targets:			
Attribute	Measure	Target	Notes
Habitat area	Hectares	Area stable or increasing, subject to natural processes, including erosion and succession	Current area unknown. It was recorded to be present but extent was not mapped from nine sub-sites during the National Shingle Beach Survey: Ross Bay, Kilbaha Bay, Clooncneen Lough and Rinevella Bay, Carrigholt Bay, Ballymacrinan Bay, Bunaclugga Bay, Corcas and Sandhills, Bromore and Ballybunnion. NB further unsurveyed areas maybe present within the site
Habitat distribution	Occurrence	No decline, subject to natural processes	Full distribution currently unknown. An excellent array of shingle beaches is known to occur, including three that are ranked of high interest (Ross Bay, Bunaclugga Bay and Clooncneen Lough and Rinevella), the last of which is associated with a lagoonal system. Habitat likely to be more widespread. See coastal habitats supporting document for further details. See also the conservation objective for coastal lagoons (1150)
Salinity regime	Occurrence	No decline, or change in habitat distribution, subject to natural processes.	Full distribution currently unknown. An excellent array of shingle beaches is known to occur, including three that are ranked of high interest (Ross Bay, Bunaclugga Bay and Clooncneen Lough and Rinevella), the last of which is associated with a lagoonal system. Habitat likely to be more widespread.
Physical structure: functionality and sediment supply	Presence/ absence of physical barriers	Maintain the natural circulation of sediment and organic matter, without any physical obstructions	Shingle features are relatively stable in the long-term and shingle beaches within this SAC appear to be functioning naturally with few artificial restrictions to beach dynamics
Vegetation structure: zonation	Percentage cover at a representative sample of monitoring stops	Maintain the typical vegetated shingle flora including the range of sub- communities within the different zones	The Carrigholt sub-site is a small site with a diverse flora. The Bunaclugga Bay sub- site supports yellow horned-poppy ( <i>Glaucium flavum</i> ), which contributes to the site's high interest ranking
Vegetation composition: negative indicator species	Percentage cover	Negative indicator species (including non-natives) to represent less than 5% cover	Negative indicators include non- native species, species indicative of

<p><b>1220 Perennial vegetation of stony banks</b>                  To maintain the favourable conservation condition of Perennial vegetation of stony banks in the Lower River Shannon SAC, which is defined by the following list of attributes and targets:</p>			
			changes in nutrient status and species not considered characteristic of the habitat.

## B.10 Map: Lower River Shannon SAC- Stony Banks

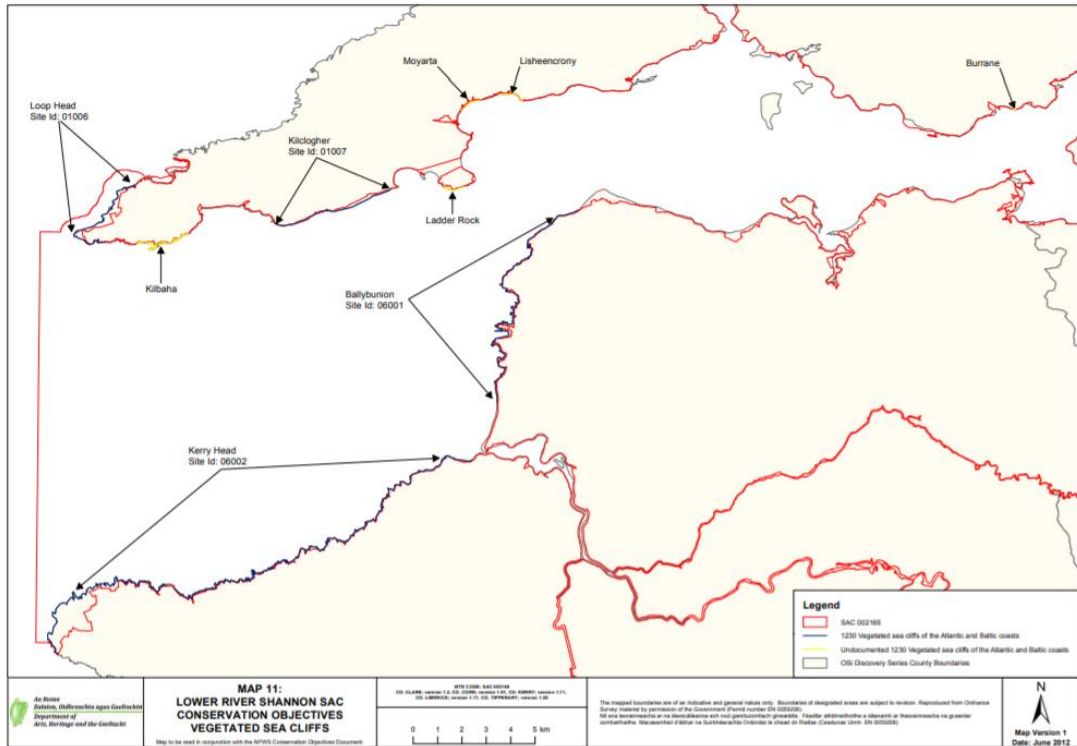




## B.11 Conservation Objectives: Vegetated sea cliffs of the Atlantic and Baltic coasts [1230]

1230 Vegetated sea cliffs of the Atlantic and Baltic coasts To maintain the favourable conservation condition of Vegetated sea cliffs of the Atlantic and Baltic coasts in Bray Head SAC, which is defined by the following list of attributes and targets:			
Attribute	Measure	Target	Notes
Habitat length	Kilometres	Area stable or increasing, subject to natural processes, including erosion. For sub-sites mapped: Kilbaha- 4.1km; Ladder Rock- 1.0km; Moyarta- 0.9km; Lisheencrony- 1.1km; Burrane- 0.2km; Kerry Head- 33.4km; Ballybunion- 15.6km; Kilclogher- 4.9km; Loop Head- 6.1km.	Nine sub-sites were identified using a combination of aerial photos and the DCENR helicopter viewer. The length of each cliff was measured (in some cases the cliff was measured in sections) to give a total estimated area of 67.3km within the SAC. Cliffs are linear features and are therefore measured in kilometres. Length of cliff likely to be underestimated.
Habitat distribution	Occurrence	No decline, subject to natural processes	Most of the SAC west of Kilcredaun Point and Kilconly Point is bounded by high rocky sea cliffs. Both hard and soft cliffs occur in this SAC
Physical structure: functionality and hydrological regime	Occurrence of artificial barriers	No alteration to natural functioning of geomorphological and hydrological processes due to artificial structures	Maintaining natural geomorphological processes including natural erosion is important for the health of vegetated sea cliff. Hydrological processes maintain flushes and in some cases tufa formations that can be associated with sea cliffs. Freshwater seepage was noted from the cliffs at Loop Head and Kilclogher. Stream or cascade was noted from Kerry Head.
Vegetation structure: zonation	Occurrence	Maintain range of sea cliff habitat zonations including transitional zones, subject to natural processes including erosion and succession	At Loop Head sub-site the zones recorded were: splash, crevice ledge and ungrazed coastal grassland on hard cliffs. At Kerry Head sub-site the zones recorded were: splash, pioneer, crevice ledge, ungrazed/grazed coastal grassland on hard cliffs and coastal grassland on soft cliffs.
Vegetation structure: vegetation height	Centimetres	Maintain structural variation within sward	
Vegetation composition: typical species and subcommunities	Percentage cover at a representative number of monitoring stops	Maintain range of subcommunities with typical species listed in the Irish Sea Cliff Survey (Barron et al., 2011)	
Vegetation composition: negative indicator species	Percentage	Negative indicator species (including non-natives) to represent less than 5% cover	
Vegetation composition: bracken and woody species	Percentage	Cover of bracken ( <i>Pteridium aquilinum</i> ) on grassland and/or heath less than 10%. Cover of woody species on grassland and or heath less than 20%	

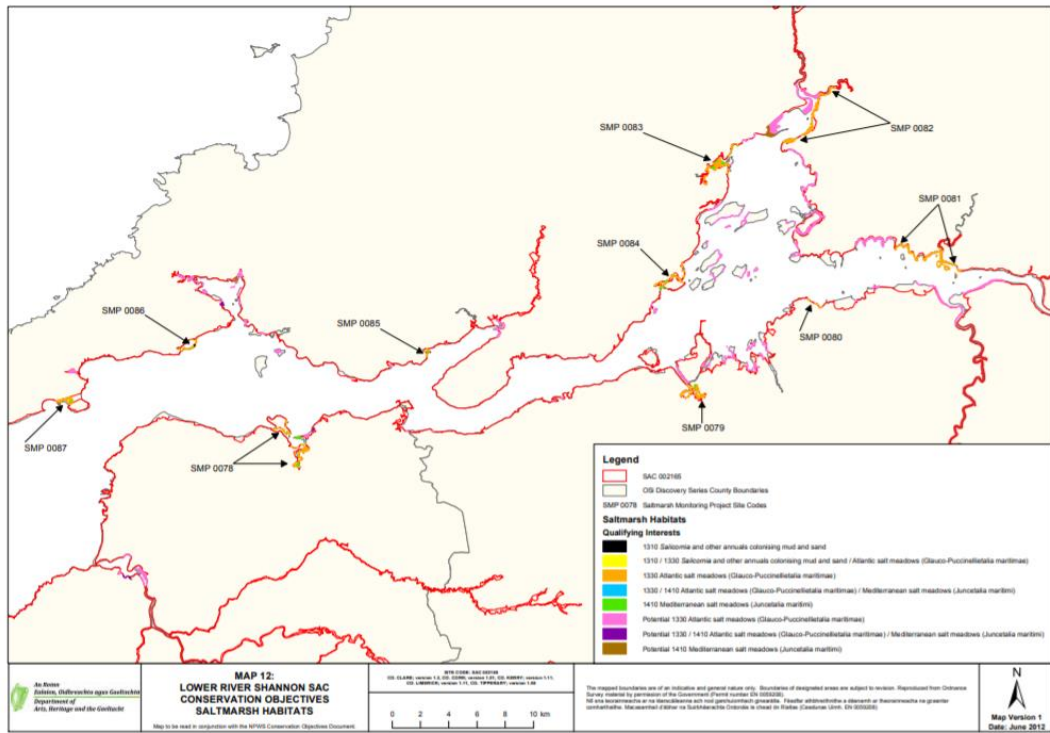
## B.12 Map: Lower River Shannon SAC- Vegetated sea cliffs of the Atlantic and Baltic coasts



## B.13 Conservation Objectives: Salicornia and other annuals colonising mud and sand [1310]

<b>1310 Salicornia and other annuals colonizing mud and sand</b> <b>To maintain the favourable conservation condition of Salicornia and other annuals colonizing mud and sand in the Lower River Shannon SAC, which is defined by the following list of attributes and targets:</b>			
Attribute	Measure	Target	Notes
Habitat area	Hectares	Area stable or increasing, subject to natural processes, including erosion and succession. For sub-sites mapped: Carrigafoyle - 0.005ha; Inishdea, Owenshere - 0.003ha; Knock - 0.029ha; Querin - 0.185ha; Rinevilla Bay - 0.001ha	Habitat recorded at five of the ten sub-sites surveyed and mapped, giving a total estimated area of 0.223ha. NB further unsurveyed areas maybe present within the site
Habitat distribution	Occurrence	No decline, or change in habitat distribution, subject to natural processes	NB further unsurveyed areas maybe present within the site. Salicornia is an annual species, so its distribution can vary significantly from year to year
Physical structure: sediment supply	Presence/absence of physical barriers	Maintain natural circulation of sediments and organic matter, without any physical obstructions	Sediment supply is particularly important for this pioneer saltmarsh community, as the distribution of this habitat depends on accretion rates.
Physical structure: creeks and pans	Occurrence	Maintain/restore creek and pan structure, subject to natural processes, including erosion and succession	Creeks deliver sediment throughout saltmarsh system. Creeks and pan structures well developed in the larger sections of the marsh at Carrigafoyle, Shepperton/Fergus Estuary and Inishdea/Owenshere
Physical structure: flooding regime	Hectares flooded; frequency	Maintain natural tidal regime	This pioneer saltmarsh community requires regular tidal inundation.
Vegetation structure: zonation	Occurrence	Maintain the range of coastal habitats including transitional zones, subject to natural processes including erosion and succession	
Vegetation structure: vegetation height	Centimeters	Maintain structural variation within sward	
Vegetation structure: vegetation cover	Percentage cover at a representative sample of monitoring stops	Maintain more than 90% of area outside creeks vegetated	

## B.14 Map: Lower River Shannon SAC-Saltmarsh Habitats



## B.15 Conservation Objectives: Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*) [1330]

Atlantic Salt Meadows [1330] To restore the favourable conservation condition of Atlantic salt meadows ( <i>Glauco-Puccinellietalia maritimae</i> ) in the Lower River Shannon SAC, which is defined by the following list of attributes and targets:			
Attribute	Measure	Target	Notes
Habitat area	Hectares	Area stable or increasing, subject to natural processes, including erosion and succession. For sub-sites mapped: Carrigafoyle- 6.774ha; Barrigone, Aughinish- 10.288ha; Beagh- 0.517ha; Bunratty- 26.939ha; Shepperton, Fergus Estuary- 37.925ha; Inishdea, Owenshere- 18.127ha; Killadysert, Inishcorker- 2.604ha; Knock- 0.576ha; Querin- 3.726ha; Rinevilla Bay- 11.883ha.	Ten sub-sites that supported Atlantic salt meadow were mapped (119.36ha) and additional areas of potential saltmarsh (376.07ha) were identified from an examination of aerial photographs, giving a total estimated area of 495.43ha. Saltmarsh habitat also occurs at 11 other sub-sites within the SAC
Habitat distribution	Occurrence	No decline, subject to natural processes	Within the sites surveyed by the SMP, estuary type saltmarsh over a mud substrate is most common and ASM is the dominant saltmarsh habitat.
Physical structure: sediment supply	Presence/absence of physical barriers	Maintain/restore natural circulation of sediments and organic matter, without any physical obstructions	Embankments along much of the shoreline are a feature of this SAC. These embankments were erected in the past and much of the site has been remodelled and large areas of land reclaimed as a result.
Physical structure: creeks and pans	Occurrence	Maintain/restore creek and pan structure, subject to natural processes, including erosion and succession	Creeks and pan structures well developed at the larger sections of ASM in the Carrigafoyle sub-site. At the ASM at Shepperton, Fergus

Atlantic Salt Meadows [1330] To restore the favourable conservation condition of Atlantic salt meadows ( <i>Glauco-Puccinellietalia maritima</i> ) in the Lower River Shannon SAC, which is defined by the following list of attributes and targets:			
			Estuary, the larger patches still retain a natural creek and salt pan structure. At Inishdea, Owenshere sub-site within some of the intact saltmarsh, there is a complex network of creeks, salt pans and depressions. At Killadysart, Inishcorker and Querin, creek and pan development is generally poor.
Physical structure: flooding regime	Hectares flooded; frequency	Maintain natural tidal regime	-
Vegetation structure: zonation	Occurrence	Maintain range of saltmarsh habitat zonation including transitional zones, subject to natural processes including erosion and succession.	Zonations to other saltmarsh habitats as well as brackish and terrestrial habitats were recorded at all sub-sites.
Vegetation structure: vegetation height	Centimetres	Maintain structural variation within sward	All of the sub-sites are grazed to some extent. Overgrazing was noted from Carrigafoyle, Shepperton, Fergus Estuary and Knock sub-sites.
Vegetation structure: vegetation cover	Percentage cover at a representative sample of monitoring stops	Maintain more than 90% of area outside creeks vegetated	Some poaching was noted from most of the sub-sites.
Vegetation composition: typical species and sub-communities	Percentage cover at a representative sample of monitoring stops	Maintain range of sub-communities with characteristic species listed in Saltmarsh Monitoring Project (McCorry & Ryle, 2009)	-
Vegetation structure: negative indicator species - <i>Spartina anglica</i>	Hectares	No significant expansion of <i>Spartina</i> . No new sites for this species with an annual spread of less than 1%	<i>Spartina</i> is a major element of the vegetation at all sub-sites in this SAC



## B.16 Conservation Objectives: Mediterranean salt meadows (*Juncetalia maritimi*) [1410]

1410 Atlantic Salt Meadows To restore the favourable conservation condition of Mediterranean salt meadows ( <i>Juncetalia maritimi</i> ) in the Lower River Shannon SAC, which is defined by the following list of attributes and targets:			
Attribute	Measure	Target	Notes
Habitat area	Hectares	Area increasing, subject to natural processes, including erosion and succession. For sub-sites mapped: Carrigafoyle- 4.193ha; Barrigone, Aughinish- 2.407ha; Bunratty- 0.865ha; Inishdea, Owenshere- 11.609ha; Killadysert, Inishcorker- 0.705ha; Knock- 0.143ha, Querin- 0.008ha; Rinevilla Bay- 2.449ha.	. Eight sub-sites that support Mediterranean salt meadow were mapped (22.379ha) and additional areas of potential saltmarsh (25.646ha) were identified from an examination of aerial photographs, giving a total estimated area of 48.025ha. Saltmarsh habitat also occurs at 11 other sub-sites within the SAC (Curtis and Sheehy-Skeffington, 1998). NB further unsurveyed areas maybe present within the site.
Habitat distribution	Occurrence	No decline, subject to natural processes	Within the sites surveyed by the SMP, estuary type saltmarsh over a mud substrate is most common
Physical structure: sediment supply	Presence/absence of physical barriers	Maintain/restore natural circulation of sediments and organic matter, without any physical obstructions	Embankments along much of the shoreline are a feature of this SAC. These embankments were erected in the past and much of the site has been remodelled and large areas of land reclaimed because of them.
Physical structure: creeks and pans	Occurrence	Maintain/restore creek and pan structure, subject to natural processes, including erosion and	The MSM at Carrigafoyle contains some

1410 Atlantic Salt Meadows To restore the favourable conservation condition of Mediterranean salt meadows ( <i>Juncetalia maritimi</i> ) in the Lower River Shannon SAC, which is defined by the following list of attributes and targets:			
		succession	large salt pans
Physical regime	structure: flooding Hectares flooded; frequency	Maintain natural tidal regime	Mediterranean salt meadow is found high up in the saltmarsh but requires occasional tidal inundation.
Vegetation structure: zonation	Occurrence	Maintain range of saltmarsh habitat zonations including transitional zones, subject to natural processes including erosion and succession.	Zonations to other saltmarsh habitats as well as brackish and terrestrial habitats were recorded at most sub-sites.
Vegetation structure: vegetation height	Centimetres	Maintain structural variation within sward	All of the sub-sites are grazed to some extent. Overgrazing was noted from Inishdea, Owenshere and Knock sub-sites
Vegetation structure: vegetation cover	Percentage cover at a representative sample of monitoring stops	Maintain more than 90% of area outside creeks vegetated	Some poaching was noted from most of the sub-sites
Vegetation composition: typical species	Percentage cover	Maintain range of sub-communities with characteristic species listed in Saltmarsh Monitoring Project (McCorry & Ryle, 2009)	
Vegetation structure: negative indicator species - <i>Spartina anglica</i>	Hectares	No significant expansion of <i>Spartina</i> . No new sites for this species with an annual spread of less than 1%	<i>Spartina</i> is a major element of the vegetation at all sub-sites in this SAC.

## B.17 Conservation Objectives: Water courses of plain to montane levels with the Ranunculus fluitantis and Callitriche-Batrachion vegetation [3260]

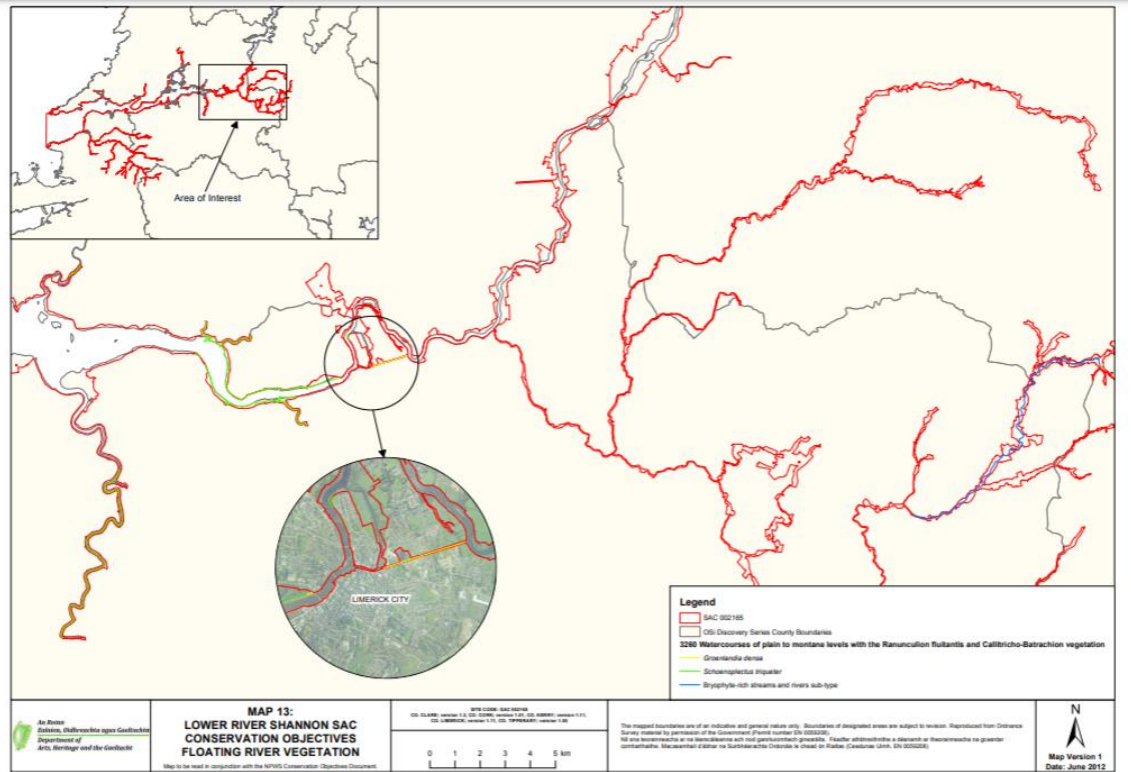
**3260 Water courses of plain to montane levels with the Ranunculus fluitantis and Callitriche-Batrachion vegetation. To maintain the favourable conservation condition of Water courses of plain to montane levels with the Ranunculus fluitantis and Callitriche-Batrachion vegetation in the Lower River Shannon SAC, which is defined by the following list of attributes and targets:**

Attribute	Measure	Target	Notes
Habitat area	Kilometres	Area stable or increasing, subject to natural processes	Three sub-types of high conservation value are known to occur in the site
Habitat distribution	Occurrence	No decline, subject to natural processes	
Hydrological regime: river flow	Metres per second	Maintain appropriate hydrological regimes	
Hydrological regime: tidal influence	Daily water level fluctuations - metres	Maintain natural tidal regime	
Hydrological regime: freshwater seepages	Metres per second	Maintain appropriate freshwater seepage regimes	
Substratum composition: particle size range	Millimetres	The substratum should be dominated by the particle size ranges, appropriate to the habitat sub-type (frequently sands, gravels and cobbles)	Although many of the high-conservation-value sub-types are dominated by coarse substrata, for certain sub-types, notably triangular club-rush ( <i>Schoenoplectus triquetus</i> ) and opposite-leaved pondweed ( <i>Groenlandia densa</i> ), fine substrata are required.
Water quality: nutrients	Milligrammes per litre	The concentration of nutrients in the water column should be sufficiently low to prevent changes in species composition or habitat condition	
Vegetation composition: typical species	Occurrence	Typical species of the relevant habitat sub-type should be present and in good condition	
Floodplain connectivity	Area	The area of active floodplain at and upstream of the habitat should be maintained	
Riparian habitat	Area	The area of riparian woodland at and upstream of the bryophyte-rich sub-type should be maintained	See Water courses of plain to montane levels with the Ranunculus fluitantis and Callitriche-Batrachion vegetation supporting document for further details. See also the conservation objective for

3260 Water courses of plain to montane levels with the Ranunculion fluitantis and Callitriche-Batrachion vegetation. To maintain the favourable conservation condition of Water courses of plain to montane levels with the Ranunculion fluitantis and Callitriche-Batrachion vegetation in the Lower River Shannon SAC, which is defined by the following list of attributes and targets:

			Alluvial forests with Alnus glutinosa and Fraxinus excelsior (Alno-Padion, Alnion incanae, Salicion albae) (91E0)
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**B.18 Map: Lower River Shannon SAC- Water courses of plain to montane levels with the *Ranunculus fluitantis* and *Callitriche-Batrachion* vegetation**



## B.19 Conservation Objectives: Molinia meadows on calcareous, peaty or clayey-silt-laden soils (*Molinia caerulea*) [6410]

[6410]. Molinia meadows on calcareous, peaty or clayey-silt-laden soils (*Molinia caerulea*) To maintain the favourable conservation condition of Molinia meadows on calcareous, peaty or clayey-silt-laden soils (*Molinia caerulea*) in the Lower River Shannon 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	Full extent of this habitat in this site is currently unknown-
Habitat distribution	Occurrence	No decline, subject to natural processes	This habitat has been recorded on the eastern bank of the Shannon, just north of Castleconnell, Co. Limerick (NPWS internal files). Full distribution of this habitat in this site is currently unknown and it almost certainly occurs elsewhere
Vegetation structure: broadleaf herb: grass ratio	Percentage	Broadleaf herb component of vegetation between 40 and 90%	
Vegetation structure: sward height	Percentage	30-70% of sward between 10 and 80cm high	
Vegetation composition: typical species	Number	At least 7 positive indicator species present, including 1 "high quality" species	
Vegetation composition: notable species	Number	No decline, subject to natural processes	A number of notable species have been recorded in this habitat at this site including smooth brome ( <i>Bromus racemosus</i> ), pale sedge ( <i>Carex pallescens</i> ) and blue-eyed grass ( <i>Sisyrinchium bermudiana</i> )
Vegetation composition: negative indicator species	Percentage	Negative indicator species collectively not more than 20% cover, with cover by an individual species less than 10%. Non-native invasive species, absent or under control	
Vegetation composition: negative indicator moss species	Percentage	Bog mosses ( <i>Sphagnum</i> spp.) not more than 10% cover; hair mosses ( <i>Polytrichum</i> spp.) not more than 25% cover	
Vegetation structure: woody species and	Percentage	Cover of woody species and bracken	

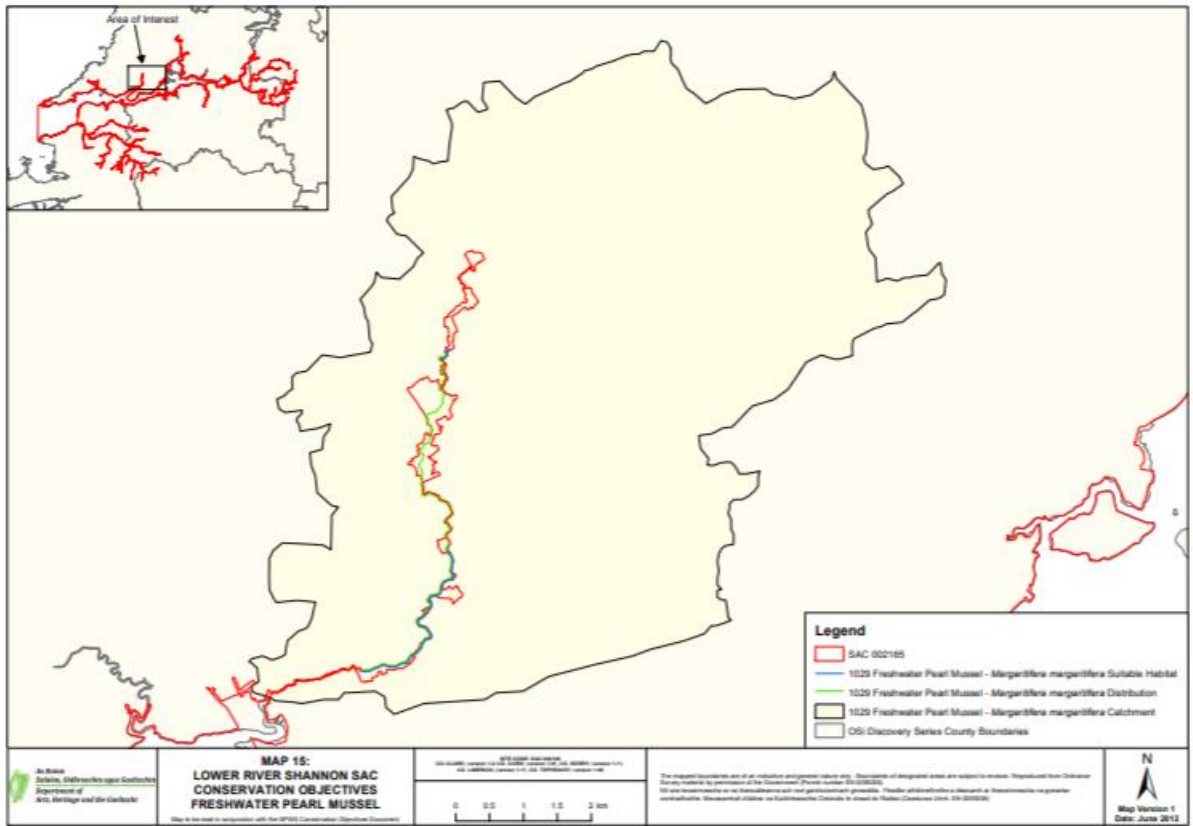


bracken (Pteridium aquilinum)		not more than 5% cover	
Physical structure: bare ground	Percentage	Not more than 10% bare ground	

## B.20 Conservation Objectives: *Margaritifera margaritifera* (Freshwater Pearl Mussel) [1029

1029 Freshwater Pearl Mussel <i>Margaritifera margaritifera</i> To restore the favourable conservation condition of Freshwater Pearl Mussel in the Lower River Shannon SAC, which is defined by the following list of attributes and targets:			
Attribute	Measure	Target	Notes
Habitat extent	Kilometres	Restore suitable habitat in more than 3.3km and any additional stretches necessary for salmonid spawning	The species' habitat covers stretches of a short coastal river; and is a combination of 1) the area of habitat adult and juvenile mussels can occupy and 2) the area of spawning and nursery habitats the host fish can occupy. Fish nursery habitat typically overlaps with mussel habitat. Fish spawning habitat is generally adjacent to mussel habitat, but may lie upstream of the generalised mussel distribution. Only those salmonid spawning areas that could regularly contribute juvenile fish to the areas occupied by adult mussels should be considered. The availability of mussel habitat and fish spawning and nursery habitats are determined by flow and substratum conditions. The habitat for the species is currently unsuitable for the survival of adult mussels or the recruitment of juveniles (DEHLG, 2010). The target is based on the stretches of river identified, from a combination of dedicated survey and incidental records, as having habitat for the species
Water quality: macroinvertebrate and phytobenthos (diatoms)	Ecological quality ratio (EQR)	Restore water quality-macroinvertebrates: EQR greater than 0.90; phytobenthos: EQR greater than 0.93	
Substratum quality: filamentous algae (macroalgae), macrophytes (rooted higher plants)	Percentage	Restore substratum quality-filamentous algae: absent or trace (<5%)	
Substratum quality: sediment	Occurrence	Restore substratum quality- stable cobble and gravel substrate with very little fine material; no artificially elevated levels of fine sediment	
Substratum quality: oxygen availability	Redox potential	Restore to no more than 20% decline from water column to 5cm depth in substrate	
Hydrological regime: flow variability	Metres per second	Restore appropriate hydrological regimes	
Host fish	Number	Maintain sufficient juvenile salmonids to host glochidial larvae	

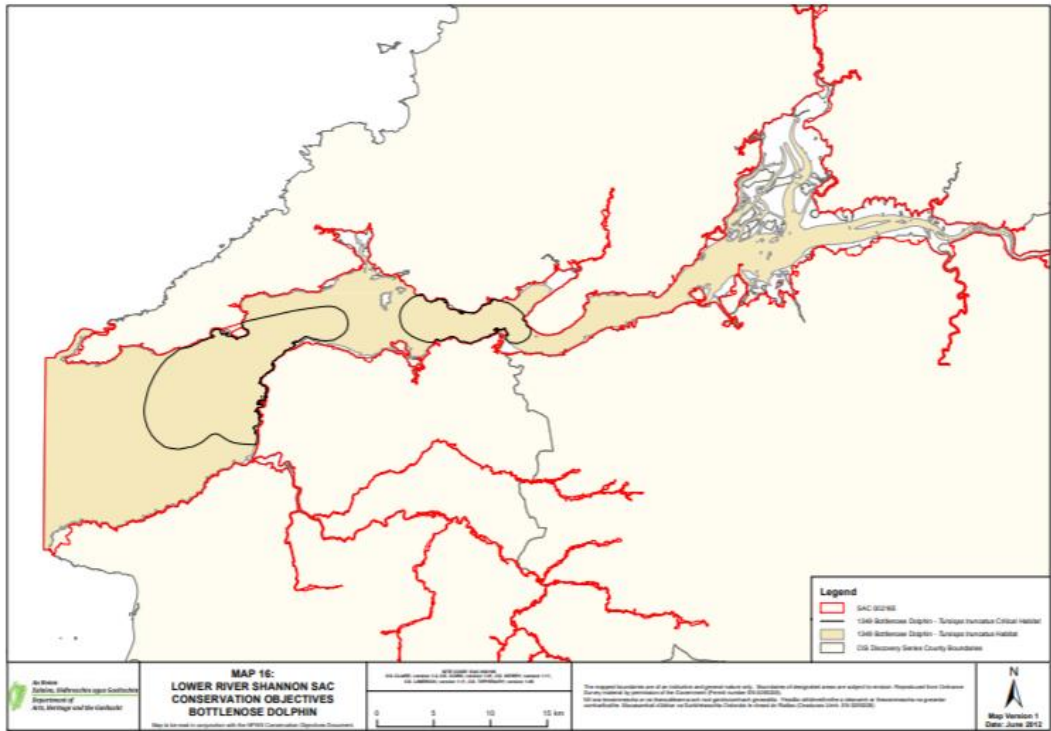
B.21 Map: Lower River Shannon SAC- Freshwater Pearl Mussel



## B.22 Conservation Objectives: Tursiops truncatus (Common Bottlenose Dolphin) [1349]

1349 Bottlenose Dolphin Tursiops truncatus To maintain the favourable conservation condition of Bottlenose Dolphin in the Lower River Shannon SAC, which is defined by the following list of attributes and targets:			
Attribute	Measure	Target	Notes
Access to suitable habitat	Number of artificial barriers	Species range within the site should not be restricted by artificial barriers to site use	
Habitat use: critical areas	Location and hectares	Critical areas, representing habitat used preferentially by bottlenose dolphin, should be maintained in a natural condition.	
Disturbance	Level of impact	Human activities should occur at levels that do not adversely affect the bottlenose dolphin population at the site	

B.23 Map: Lower River Shannon SAC- Common Bottlenose Dolphin



**C Denyer Ecology (July 2020) King's Island Quay  
Wall Bryophyte Assessment**





## **KING'S ISLAND QUAY WALL BRYOPHYTE ASSESSMENT**

**July 2020**

**Report produced by Denyer Ecology for:  
JBA Consulting**

11 Dargle View, Rathfarnham, Dublin, D16 XY51, Ireland T +353 86 2379153 joanne@denyerecology.com  
www.denyerecology.com

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## 1 INTRODUCTION

### 1.1 Background and aims

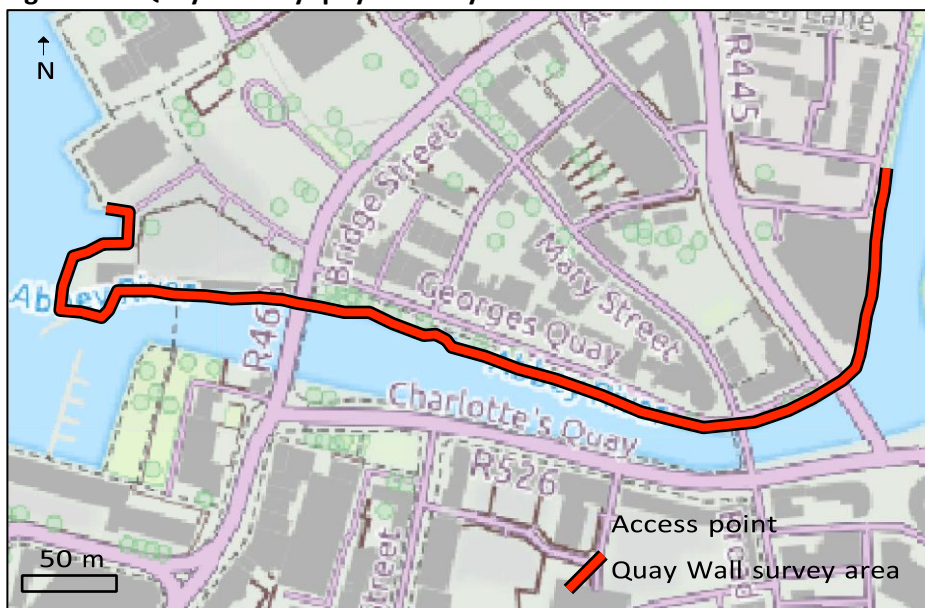
A bryophyte-rich sub-type of the Annex I habitat 'Water courses of plain to montane levels with the *Ranunculus fluitans* and *Callitriche-Batrachion* vegetation' [3260] occurs within the Lower River Shannon Special Area of Conservation (SAC). Some of the bryophyte species that indicate this habitat type have been recorded growing on sections of quay wall on King's Island, as the river is largely freshwater in this location. The proposed King's Island Flood Relief Scheme includes works to the quay walls which could potentially impact on vegetation on the walls. The aim of this assessment was to:

- Consult with relevant organisations (e.g. NPWS) and review relevant literature to clarify the identification of the 'bryophyte-rich sub-type' of the Annex I habitat 3260.
- Describe the bryophyte communities present on the quay walls.
- Use the above information to evaluate the ecological value of the quay wall bryophyte (and vascular plant) communities.
- Assess any potential impacts to the quay wall bryophyte (and vascular plant) communities
- Identify potential avoidance/ mitigation measures to protect any identified quay wall habitats of high ecological value.

### 1.2 Site

The survey area includes the quay wall along the southern boundary of King's Island and part of the eastern and western boundaries (Figure 1.1).

Figure 1.1. Quay wall bryophyte survey area



Maps © Thunderforest, Data © OpenStreetMap contributors

## 2 METHODOLOGY

### 2.1 Desktop information

The following resources were consulted:

- GIS boundaries of designated site data (data accessed via NPWS website).
- Aerial photography (Bing Maps).
- British Bryological Society Atlas of British and Irish bryophytes (Blockeel et al., 2014a & 2014b).
- British Bryological Society Atlas dataset
- Lower River Shannon SAC: Conservation objectives supporting document - Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitriche-Batrachion* vegetation (Habitat code 3260).

### 2.2 Consultation

The following organisations and individuals were consulted for this project:

- National Parks and Wildlife Service (bryophyte specialist and river specialist)

### 2.3 Quay wall survey

The quay wall survey was undertaken from vantage points along the quay wall due to access limitations. In one location the lower river wall was accessed via steps (Figure 1.1). Bryophyte and vascular plant species were identified to species level where possible. The focus was on species within the tidal flood zone, but some species from higher up the wall (above the high water line) were also recorded. Where relevant, habitats are referred to using the Guide to Habitats in Ireland (Fossitt, 2000), these are underlined in the text.

### 2.4 Ecological evaluation

The ecological importance of the survey area was assessed using the criteria listed in the *Guidelines for Assessment of Ecological Impacts of National Roads Schemes* (NRA, 2009) and the *Guidelines for Ecological Impact Assessment in the UK and Ireland* (CIEEM, 2016). The assessment was based on the presence and quality of the springs and associated species and does not taken into account fauna species.

Ecological evaluation scheme:

- International ecological importance
- National ecological importance
- County ecological importance
- Local (higher value) ecological importance
- Local (lower value) ecological importance

### 2.5 Plant species nomenclature

Vascular plant nomenclature will follow that of the *New Flora of the British Isles*. 4th Edition (Stace, 2019). The bryophyte nomenclature adopted by Blockeel et al. (2014a & b) is used; this is based on the *Checklist of British and Irish bryophytes* (Hill et al., 2008) with minor modifications to reflect recent taxonomic changes.

### 2.6 Limitations

Most of the river and walls are inaccessible. However, the main bryophyte species could be recorded from a distance by an experienced recorder as diversity is not high. The river edge and wall were accessed in one location and this verified the species present. The rare species listed for the 'bryophyte-rich sub-type' of 3260 in the Lower Shannon River SAC (NPWS, 2012) would not be expected to occur in the habitats recorded within the survey area.

### 3 REVIEW OF BRYOPHYTES AND ANNEX I 3260 HABITAT

Relevant information (from national and European reports and guidance documents) on the identification of 3260 Floating River Vegetation and references to bryophytes is summarised below. Key bryophyte species and information are highlighted in bold where relevant.

#### 3.1 Interpretation manual of European Union habitats (EC, 2007)

- Water courses of plain to montane levels, with submerged or floating vegetation of the *Ranunculion fluitantis* and *Callitriche-Batrachion* (low water level during summer) or aquatic mosses.
- Plants: *R. trichophyllum*, *R. fluitans*, *R. peltatus*, *R. penicillatus* ssp. *penicillatus*, *Ranunculus penicillatus* subsp. *pseudofluitans*, *R. aquatilis*, *Myriophyllum* spp., *Callitriche* spp., *Sium erectum* (*Berula erecta*), *Zannichellia palustris*, *Potamogeton* spp., ***Fontinalis antipyretica***.
- This habitat is sometimes associated with *Butomus umbellatus* bank communities.

#### 3.2 Article 17 report 2019 (NPWS, 2019)

- Broad definition of Annex I habitat, including **upland**, flashy, **oligotrophic**, **bryophyte** and algal-dominated rivers, to tidal reaches dominated by higher plants.
- **Low-nutrient, high-velocity river types** are associated with **high bryophyte diversity**, cascades, riffles and riparian woodland.
- Weekes et al. (2018) described four main categories of river macrophyte communities and found that **diversity was highest in bryophyte communities**.
- In Ireland, many river communities represent an altered state caused by anthropogenic impacts on habitats, particularly changes in hydrology and morphology. Site-specific conservation objectives for the habitat identify site-specific vegetation and other communities of high conservation value where possible (sub-types).
- High conservation value sub-types are associated with natural hydrological regimes, including functioning floodplains.
- **Typical species have not been fully defined** but may include higher plants, **bryophytes**, algae and invertebrates. The list of typical species for habitat 3260 was based on the interpretation manual of EU habitats (CEC, 2013) and is the same as that reported for the 2007-2012 cycle: *Berula erecta*, *Callitriche* spp., ***Fontinalis antipyretica***, *Myriophyllum* spp., *Potamogeton* spp., *Ranunculus aquatilis*, *Ranunculus peltatus*, *Ranunculus penicillatus*, *Ranunculus trichophyllum*, *Zannichellia palustris*.

#### 3.3 Article 17 report 2013 (NPWS, 2013)

- Species – *Ranunculus trichophyllum*, *Ranunculus penicillatus*, *Ranunculus peltatus*, *Ranunculus aquatilis*, *Myriophyllum* spp., *Callitriche* spp., *Sium erectum* (*Berula erecta*), *Zannichellia palustris*, *Potamogeton* spp., and ***Fontinalis antipyretica***.
- The plants that are characteristic of the habitat are listed in the Interpretation Manual (EC, 2003) and include a number of *Ranunculus* species and all *Callitriche* species, including other submerged aquatic plants.
- The community *Callitriche-Batrachion* is described in White and Doyle (White and Doyle, 1982) and includes species of the *Ranunculus* subgenus *Batrachium* and two species of *Callitriche*, *C. hamulata* and *C. platycarpa* as diagnostic species.
- There are few published records for descriptions of this habitat in Ireland and no comprehensive island-wide descriptions. No specific assessments of typical species have been undertaken to date.
- **The EU (2003) definition of this habitat is very broad, especially when the presence of aquatic mosses is taken into account.** Using this broad definition, the habitat will be found in most watercourses in Ireland. Despite work by Kelleher (2011), there is to date no accepted definition of this habitat, its sub-types and their distribution in Ireland.

- The description of habitat 3260 is broad, covering rivers from **upland bryophyte** and macroalgal **dominated stretches**, to lowland depositing rivers with pondweeds and starworts (EC, 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).

### 3.4 Irish National Vegetation Classification scheme for aquatic river macrophytes (Weekes et al., 2018)

- This describes four main river vegetation categories: 1) Bryophyte-dominated aquatic vegetation; 2) bryophyte-dominated marginal vegetation; 3) vascular plant-dominated aquatic vegetation; and, 4) vascular plant-dominated marginal/ emergent vegetation.
- 46% of plots were bryophyte-dominated communities.
- There is no discussion of the affinity of the vegetation categories or communities with Annex I 3260 vegetation.

**3.5 Irish Vegetation Classification – FW2 *Ranunculus penicillatus-Fontinalis antipyretica* group** The aquatic vegetation communities within the *Ranunculus penicillatus-Fontinalis antipyretica* group of the Irish Vegetation Classification are summarised in Table 3.1 below. This uses information in the full synopsis for each aquatic community (available to download from <https://www.biodiversityireland.ie/projects/national-vegetation-database/irish-vegetationclassification/explore/>).

**Table 3.1. Summary of key characteristics of Irish Vegetation Classification FW2 communities**

Community name and code	Vegetation and key species*	Annex I correspondence	Conservation value
FW2a: <i>Fontinalis antipyretica</i> – <i>Myriophyllum alterniflorum</i> aquatic community	Species-poor, bryophyte-dominated aquatic community. <i>Fontinalis antipyretica</i> is the only constant species and can form extensive submerged or floating patches. The most likely other bryophytes to be seen here are <i>Rhynchostegium riparioides</i> , <i>Leptodictyum riparium</i> and <i>Chiloscyphus polyanthos</i> . In the more nutrient-poor acidic streams of the uplands, <i>Fontinalis squamosa</i> may be found.	No significant correspondence	This is a species-poor community of relatively low intrinsic conservation value
FW2b: <i>Rhynchostegium riparioides</i> – <i>Chiloscyphus polyanthos</i> aquatic community	Bryophytes dominate this aquatic community and vascular plants seldom occur. <i>Rhynchostegium riparioides</i> is the only constant species. The liverwort <i>Chiloscyphus polyanthos</i> and the moss <i>Fontinalis antipyretica</i> are also frequent components. <i>Conocephalum conicum</i> , <i>Pellia endiviifolia</i> and <i>Marchantia polymorpha</i> are occasionally found. Nutrient-poor, acidic streams in the uplands favour <i>Scapania undulata</i> and <i>Fontinalis squamosa</i> , the latter of which can grow abundantly in those waters. Conversely, in more base-rich situations, <i>Cratoneuron filicinum</i> can dominate.	No significant correspondence	This is a fairly bryophyte-rich community but typically of relatively low conservation value.



Community name and code	Vegetation and key species*	Annex I correspondence	Conservation value
FW2c: <i>Ranunculus penicillatus</i> – <i>Fontinalis antipyretica</i> aquatic community	Mid-channel expanses of the floating leaves of <i>Ranunculus penicillatus</i> (subsp. <i>penicillatus</i> ) are the key feature of this aquatic community. <i>Fontinalis antipyretica</i> is also a constant species in the channel but is never abundant <u>Constant species</u> <i>Ranunculus penicillatus</i> (V) <i>Fontinalis antipyretica</i> (V) <u>Additional bryophytes</u> <i>Leptodictyum riparium</i> (I) <i>Rhynchostegium riparioides</i> (I) <i>Chiloscyphus polyanthos</i> (I) <i>Fontinalis squamosa</i> (I) <i>Marchantia polymorpha</i> (I) <i>Scapania undulata</i> (I)	<b>3260 Floating river vegetation</b>	‘Due to the relative abundance of crowfoots ( <i>Ranunculus</i> spp. subgenus <i>Batrachion</i> ) almost all examples of this community correspond with the EU HD Annex I habitat 3260 Floating river vegetation’
FW2D: <i>Apium nodiflorum</i> – <i>Ranunculus penicillatus</i> aquatic community	This aquatic community has a notable floating-leaf component, with <i>Ranunculus penicillatus</i> (subsp. <i>penicillatus</i> ) a constant species, as is <i>Fontinalis antipyretica</i> . <u>Constant species</u> <i>Apium nodiflorum</i> (V) <i>Ranunculus penicillatus</i> (V) <i>Fontinalis antipyretica</i> (IV) <i>Callitriche stagnalis</i> (IV) <u>Additional bryophytes</u> <i>Leptodictyum riparium</i> (III) <i>Rhynchostegium riparioides</i> (III)	<b>3260 Floating river vegetation</b>	‘Almost all examples of this community with a relative abundance of crowfoots ( <i>Ranunculus</i> spp. subgenus <i>Batrachion</i> ) correspond with the EU HD Annex I habitat 3260 Floating river vegetation.’
FW2E: <i>Apium nodiflorum</i> – <i>Rorippa nasturtium-aquaticum</i> agg. aquatic community	Variable community of watercourses in which a variety of species can dominate. <i>Apium nodiflorum</i> and <i>Rorippa nasturtium-aquaticum</i> agg. are constants and lend a strong forb element to the rather diverse marginal/emergent vegetation. Bryophyte element usually consists of <i>Leptodictyum riparium</i> , <i>Fontinalis antipyretica</i> and <i>Rhynchostegium riparioides</i> . <u>Constant species</u> <i>Apium nodiflorum</i> (IV) <i>Rorippa nasturtium-aquaticum</i> agg. (IV) <u>Additional bryophytes</u> <i>Leptodictyum riparium</i> (III) <i>Fontinalis antipyretica</i> (III) <i>Rhynchostegium riparioides</i> (II) <i>Pellia endiviifolia</i> (I) <i>Brachythecium rivulare</i> (I) <i>Brachythecium plumosum</i> (I) <i>Fissidens crassipes</i> (I) <i>Cinclidotus fontinaloides</i> (I) <i>Brachythecium rutabulum</i> (I)	<b>3260 Floating river vegetation</b>	‘Almost all examples of this community with a relative abundance of crowfoots ( <i>Ranunculus</i> spp. subgenus <i>Batrachion</i> ) correspond with the EU HD Annex I habitat 3260 Floating river vegetation.’

Community name and code	Vegetation and key species*	Annex I correspondence	Conservation value
FW2F: <i>Potamogeton pectinatus</i> – <i>Myriophyllum spicatum</i> aquatic community	<i>Potamogeton pectinatus</i> dominant and the only constant species	1150 Lagoons* / 3150 Eutrophic lakes (not 3260)	'Many examples of this community occur in water bodies that qualify as EU HD Annex I priority habitat 1150 Lagoons.'

\*Nomenclature as per IVC classification where some older names are used

### 3.6 Review of Floating River Vegetation in Ireland (Kelleher, 2011)

- This review states that the data from current work and from previous studies does not aid habitat definition in the traditional phytosociological and objective sense and so a more subjective approach is necessary.
- Floating River Vegetation definition can be restricted to that given by White and Doyle (1982) as the *Callitricho–Batrachion* community which includes species of the *Ranunculus* subgenus *Batrachium* and two species of *Callitriche*, *C. hamulata* and *C. platycarpa* as diagnostic species.
- There are two dominant species of *Ranunculus* in FRV in the Republic of Ireland, these are *R. penicillatus* and *R. peltatus*.
- This review states that a more accurate definition of FRV habitat is required as current habitat descriptions could be interpreted as including '*almost all watercourses as Fontinalis antipyretica is found in flowing water aquatic habitats*'. '*For conservation purposes it is necessary to be able to define more accurately the habitat so that optimal conditions can be determined.*' '*If the definition of the Callitricho- Batrachion from White and Doyle (1982) is used for FRV in an Irish context, the number of watercourses can be narrowed and a more meaningful and manageable definition of the habitat is possible.*' Therefore this review takes an approach that FRV definition should be based on vascular plants and the *RanunculusBatrachium* distribution.

### 3.7 White and Doyle (1982)

- Briefly describe a range of aquatic plant communities, including the *Callitricho-Batrachion* community. The diagnostic species are listed as *Ranunculus* sub-genus *Batrachium*, *Callitriche hamulata* and *C. platycarpa*. *Potamogeton perfoliatus* and *Myriophyllum* sp. are listed as associate species. In addition, some alliances within the Pondweed class (*Potametea*) would fit the broad approach to classification of this habitat. Any bryophyte component is not listed.

### 3.8 JNCC (UK) Background to 3260 SAC Site selection

- This habitat type is characterised by the abundance of water-crowfoots *Ranunculus* spp., subgenus *Batrachium* (*Ranunculus fluitans*, *R. penicillatus* ssp. *penicillatus*, *R. penicillatus* ssp. *pseudofluitans*, and *R. peltatus* and its hybrids).
- There are several variants of this habitat in the UK. In each, *Ranunculus* species are associated with a different assemblage of other aquatic plants, such as *Rorippa nasturtiumaquaticum*, *Callitriche* spp., *Sium latifolium* and *Berula erecta*, *Myriophyllum* spp. and *Myosotis scorpioides*. In some rivers, the cover of these species may exceed that of *Ranunculus* species.
- Sub-type 1 is found on rivers on chalk substrates. The community is characterised by *Ranunculus peltatus* (spring-fed headwater streams), *R. penicillatus* ssp. *pseudofluitans* (middle reaches), and *R. fluitans* (downstream sections). *Ranunculus* is typically associated in the upper and middle reaches with *Callitriche obtusangula* and *C. platycarpa*.

- Sub-type 2 is found on other substrates, ranging from lime-rich substrates, through soft sandstone and clay to more mesotrophic and oligotrophic rocks. Faster-flowing western rivers on harder rocks support *Ranunculus penicillatus* ssp. *penicillatus*, while western and northern rivers on sandstone or alluvial substrates often support both *R. penicillatus* ssp. *penicillatus* and *R. fluitans*. Elsewhere in the UK they contain a mixture of species, and hybrids, but rarely support *R. penicillatus* ssp. *penicillatus* or *R. fluitans*. Associated species include *Berula erecta*, *Callitriche obtusangula*, *Potamogeton crispus*, *P. pectinatus* and *Zannichellia palustris*. *Butomus umbellatus* is an occasional bank-side associate.
- Sub-type 3 is a mesotrophic to oligotrophic community found on **hard rocks in the north and west**. Rivers in Wales, Northern Ireland and south-west England are significant for the occurrence of *Ranunculus penicillatus* ssp. *penicillatus*. Other typical species include the ***Fontinalis squamosa***, *Myriophyllum alterniflorum* and *Callitriche hamulata*. More oligotrophic examples of this community lack *Ranunculus* spp. and are dominated by *M. alterniflorum*, *C. hamulata* and *Potamogeton polygonifolius*.
- 3260 is widespread in Europe, though examples on chalk (sub-type 1) are rare
- 3260 is widespread in rivers in the UK, especially on softer and more mineral-rich substrates.

### 3.9 Classification of 3260 vegetation communities in the United Kingdom

The 'Ecology of Watercourses Characterised by Ranunculion fluitantis and Callitriche-Batrachion Vegetation' (Hatton-Ellis & Grieve, 2003) is an account of the ecological requirements of watercourses characterised by Floating River Vegetation that was produced as part of Life in UK Rivers project. This work was carried out using only British data, but the authors aim is that the classification can provide a broad framework within Europe, until more detailed analysis is available from other member states. There are differences between the UK and Ireland, for instance some species have different habitat preferences in the two geographic areas. An example is *Ranunculus penicillatus* subsp. *penicillatus*, which occurs only in base-poor water in Britain, whereas in Ireland it has a much broader ecological tolerance and distribution. <sup>[1]</sup> <sub>SEP</sub>

The publication classifies six Floating River Vegetation (*Callitriche-Batrachion*) communities:

CB1: Lowland, low-gradient *Potamogeton/Sagittaria* eutrophic river community

CB2: Base-rich *Ranunculus penicillatus* ssp. *pseudofluitans*-*Callitriche obtusangula* rivers, including chalk streams

CB3: Large *Ranunculus* rivers

CB4: Smaller meso-eutrophic rivers

CB5: **Atlantic bryophyte** *Callitriche hamulata*/*Ranunculus penicillatus* ssp. *penicillatus* rivers

CB6a: Slow-flowing, base-poor rivers

CB6b: **Fast-flowing, bryophyte-dominated rivers**

### 3.10 Irish SAC Conservation Objectives

Published Conservation Objectives are available for a number of SACs which have Floating River Vegetation 3260 as a Qualifying Interest (listed in NPWS, 2019). These have been summarised in Table 3.2 and any mention of bryophytes/ bryophyte species/ bryophyte rich 'sub-types' highlighted.

**Table 3.2. 3260 bryophyte communities listed in SAC conservation objectives**

SAC site and code	Conservation objectives document	Specific bryophyte reference in relation to 3260	Bryophyte species associated with 3260
Slaney River Valley SAC 000781	Version 1 (2011)	No	n/a
River Barrow and River Nore SAC 002162	Version 1 (2011)	Tufaceous sub-type of with bryophytes	None listed

SAC site and code	Conservation objectives document	Specific bryophyte reference in relation to 3260	Bryophyte species associated with 3260
Lower River Shannon SAC 002165	Version 1 (2012)	Bryophyte rich-sub-type identified. (See section 3.11 for more detail)	<i>Schistidium platyphyllum</i> , <i>Philonotis caespitosa</i> , <i>Cinclidotus riparius</i> , <i>Ephemerum crassinervium</i> subsp. <i>rutheanum</i> . <i>Ephemerum cohaerens</i> , <i>Fissidens monguillonii</i> , <i>Fontinalis antipyretica</i> , <i>Platyhypnidium riparioides</i> , <i>Sciuro-hypnum plumosum</i> , <i>Cinclidotus fontinaloides</i> , <i>Hygroamblystegium tenax</i> , <i>Aneura pinguis</i> , <i>Fissidens crassipes</i> , <i>Racomitrium affine</i> , <i>Chiloscyphus polyanthos</i> , <i>Fissidens viridulus</i> , <i>Leptodictyum riparium</i> , <i>Trichostomum brachydontium</i> and <i>Scapania undulata</i> .
Blackwater River (Cork/Waterford) SAC 002170	Version 1 (2012)	No	n/a
Black Head-Poulsallagh Complex SAC 000020	Version 1 (2014)	Caher River (groundwater fed) on limestone and with tufa deposits.	Upper sections of river with <i>Fontinalis antipyretica</i> . Lower sections with tufa spring species. Fringing bryophyte communities are an integral part of the structure and functioning of river systems.
Connemara Bog Complex SAC 002034	Version 1 (2015)	No	n/a
The Gearagh SAC 000108	Version 1 (2016)	'It is likely that the river and stream channels, which are almost entirely within the woodland, have limited vascular plants and are dominated by bryophytes.'	<i>Fontinalis antipyretica</i> , <i>Leskea polycarpa</i> , <i>Brachythecium rivulare</i> , <i>Calliergon cordifolium</i> , <i>Climacium dendroides</i> , <i>Conocephalum conicum</i> , <i>Hygroamblystegium tenax</i> , <i>Leskea polycarpa</i> , <i>Pellia epiphylla</i> , <i>Rhizomnium punctatum</i> and <i>Sciuro-hypnum plumosum</i> , <i>Riccia cavernosa</i>
Lough Corrib SAC 000297	Version 1 (2017)	'Any high conservation value sub-types in the SAC will be associated with natural, fast and highly variable flows.' Mentions 'Bryophyte-rich and tufaceous streams and rivers' but these also correspond to Annex I 7220 habitat.	n/a

SAC site and code	Conservation objectives document	Specific bryophyte reference in relation to 3260	Bryophyte species associated with 3260
Killarney National Park, Macgillycuddy's Reeks and Caragh River Catchment SAC 000365	Version 1 (2017)	High conservation value rivers include those associated with waterfalls/cascades and important bryophyte and fern communities.	n/a
Owenduff/Nephin Complex SAC 000534	Version 1 (2017)	The SAC was selected for a species-poor sub-type dominated by bryophytes and algae and with limited vascular plants.	<i>Bryum riparium</i>
Glanmore Bog SAC 001879	Version 1 (2017)	The rivers and streams are generally fast-flowing, with cascades and waterfalls, and are likely to be dominated by macroalgae and bryophytes, with limited submerged or emergent higher plant	A number of Near Threatened bryophytes of damp rock near streams and waterfalls are known to occur in the SAC [however these are not 3260 species]
Mweelrea/Sheeffry/Erriff Complex SAC 001932	Version 1 (2017)	No	<i>Fissidens viridulus</i> , <i>Fontinalis squamosa</i> , <i>Hygrohypnum duriusculum</i> , <i>Bryum riparium</i> and <i>Fissidens serrulatus</i>
Cloghernagore Bog and Glenveagh National Park SAC 002047	Version 1 (2017)	Yes. The rivers and streams are generally fast-flowing, with cascades and waterfalls, and are likely to be dominated by macroalgae and bryophytes.	<i>Schistidium agassizii</i>
Lower River Suir SAC 002137	Version 1 (2017)	Some fast-flowing rivers occur that should, naturally, be dominated by macroalgae and bryophytes	No known records for rare or threatened bryophytes from the rivers in the SAC
Moyree River System SAC 000057	Version 1 (2017)	No	n/a

### 3.11 Lower River Shannon SAC

Three high conservation elements (sub-types) have been identified for this the site:

1. *Groenlandia densa*
2. *Schoenoplectus triqueter*
3. **Bryophyte-rich streams and rivers**

The first two sub-types are associated with tidal reaches of rivers, while the **latter sub-type** (3) is found in **fast-flowing stretches of unmodified streams and rivers**. In addition to these three subtypes, it is likely that other high-conservation value sub-types exist within the site. Further investigation of all sub-types is required.

- The bryophyte sub-type is associated with natural, fast and highly variable flows. Groundwater discharges may be important in some areas of the bryophyte-rich sub-type.
- A rich bryophyte flora has been recorded from the Bilboa River, Mulkear catchment, particularly the steeply graded section above the confluence of the Gortnageragh River. Two

RDB species recorded are *Schistidium platyphyllum* Vulnerable (VU) and *Philonotis caespitosa* Near Threatened (NT) (Lockhart et al., 2012). The bryophyte-rich habitat was found in mature, relatively undisturbed, river stretches of 10-12 m, occasionally up to 20 m, wide. The mapped sub-type extends of c 13km. The bryophyte flora of the Bilboa River requires conservation of riparian woodland in order to maintain humid conditions.

- A bryophyte-dominated community was also recorded in the narrower (1-4 m wide) channels in the Mulkear system.
- *Cinclidotus riparius* 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.
- There are likely to be other stretches with bryophyte-rich sub-types. *Ephemerum crassinervium* subsp. *rutheanum* (NT) and *Ephemerum cohaerens* (VU) are two mud-dwelling mosses associated with the draw-down zones of lowland rivers and lakes. These are both known from the River Shannon upstream of the SAC. *Fissidens monguillonii* (NT) is 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.
- *Fontinalis antipyretica* (characteristic species of 3260) is an aquatic generalist that can be found from some metres depth in lakes to periodically inundated areas (Lockhart et al., 2012).
- *Schistidium platyphyllum* and *Philonotis caespitosa* are found on in-stream boulders in the Bilboa river.
- Common aquatic bryophytes species in the bryophyte rich sub-type include: *Cinclidotus fontinaloides*, *Fontinalis antipyretica*, *Platyhypnidium riparioides*, *Racomitrium affine*, *Sciurohypnum plumosum* and occasionally *Aneura pinguis*, *Chiloscyphus polyanthos*, *Fissidens crassipes*, *F. viridulus*, *Hygroamblystegium tenax*, *Leptodictyum riparium*, *Scapania undulata* and *Trichostomum brachydontium*. *Ranunculus penicillatus* is the most widespread associated vascular plant.

### 3.12 Key points from review

- Typical species for 3260 in Ireland have not been fully defined. The current species list (NPWS, 2019) only includes one bryophyte. *Fontinalis antipyretica*, which is typical of mesotrophic to eutrophic waters, often in lowland watercourses. Species of upland bryophyte dominated watercourses are not defined in the latest Article 17 report (NPWS, 2019).
- The typical species lists (NPWS, 2019; EC, 2007) do not mean that one of these species on its own (e.g. *Fontinalis antipyretica*) would constitute 3260.
- Bryophyte dominated aquatic communities are frequent in Ireland, particularly in upland eroding watercourses. The aquatic moss dominant type of 3260 usually refers to upland eroding rivers with oligotrophic water, high flow and high cover and diversity of bryophytes.
- Where lowland, depositing, watercourses have been listed as a 'bryophyte rich sub-type' of 3260 in Ireland, this is because of the presence of one or more rare or protected species.
- Some reviews and data sources do not include bryophyte dominated watercourses as having affinity with 3260 and require vegetation with vascular plants within *Ranunculus* (subgenus *Batrachium*) to be present. However, the Irish national approach (Article 17 report definitions) does include bryophyte dominated upland eroding watercourses and those which are considered a 'bryophyte rich sub-type'. The classification system developed in the UK (Hatton-Ellis & Grieve, 2003) for 3260 does include one bryophyte dominant community: 'Fast-flowing, bryophyte-dominated rivers' (CB6b).



#### 4 QUAY WALL VEGETATION COMMUNITIES

The quay walls Stone walls and other stonework (BL1) within the survey area support a vascular plant and bryophyte flora. The river is tidal in this location, but largely freshwater Depositing/lowland rivers (FW2). The plant communities are zoned according to their location on the wall and hence tidal influence. Additional example photographs of each of the zones are shown in Appendix A.

##### 4.1 Algal zone

The zone lowest on the wall, which has the greatest submergence period, is dominated by algae (Photograph 4.1). In many areas this also grades into the aquatic bryophyte zone (shown as red and orange arrows in Appendix A).

**Photograph 4.1. Example of algal zone on quay wall (orange arrow)**



##### 4.2 Aquatic bryophyte zone

The aquatic bryophyte zone is usually above the algal zone, but sometimes the algal zone is absent/sparse, or the aquatic bryophytes grow within the algal zone (see photographs in Appendix A and Photograph 4.2). The aquatic bryophyte species recorded within this zone are:

*Cinclidotus fontinaloides* (locally abundant)

*Fontinaloides antipyretica* (locally abundant)

*Platyhypnidium plumosum*

*Sciuro-hypnum plumosum*

In addition, some non-aquatic bryophyte species occurred at the top of this zone and are probably intermittently inundated (Photograph 4.2):

*Bryum capillare*

*Didymodon rigidulus*

*Orthotrichum cupulatum*

*Schistidium apocarpum*



**Photograph 4.2. Example of aquatic bryophyte zone on quay wall (red arrows) and non-aquatic bryophytes at the top of the high water line (green arrow)**



### 4.3 Dry wall bryophytes

Above the high-water line, particularly on the tops of the walls, there is a community of 'dry wall' bryophytes. Species present include:

*Brachythecium rutabulum*

*Orthotrichum anomalum*

*Bryum capillare*

*Orthotrichum cupulatum*

*Didymodon rigidulus*

*Schistidium crassipilum*

*Grimmia pulvinata*

*Schistidium apocarpum*

*Homalothecium sericeum*

*Tortula muralis*

**Photograph 4.3. Example of 'dry wall' bryophyte zone (blue arrow)**



#### **4.4 Tall-herb swamp vascular plant zone**

Plants typical of wetlands such as Tall-herb swamps (FS2) are locally frequent along the quay wall. These occur throughout the upper tidal range of the river, either growing in small flat areas which are inundated at high tide (Photograph 4.4) or directly from the wall itself (see additional photographs in Appendix A). Species typical of dry walls (usually non-native species) are frequent above the high water level.

Typical wetland species:

*Alnus glutinosa* (Alder)  
*Angelica sylvestris* (Wild Angelica)  
*Caltha palustris* (Marsh-marigold)  
*Filipendula ulmaria* (Meadowsweet)  
*Jacobaea aquatica* (Marsh Ragwort)  
*Lythrum salicaria* (Purple-loosestrife)  
*Mentha aquatica* (Water Mint)  
*Myosotis scorpioides* (Water Forget-me-not)  
*Oenanthe crocata* (Hemlock Water-dropwort)  
*Phragmites australis* (Common Reed)  
*Rumex crispus* subsp. *uliginosus* (Curled Dock)  
*Salix cinerea* (Grey Willow)  
*Scrophularia auriculata* (Water Figwort)

Invasive (non-native) vascular plants:

*Impatiens glandulifera* (Indian/ Himalayan Balsam)  
*Heracleum mantegazzianum* (Giant Hogweed)

Dry wall species:

*Asplenium scolopendrium* (Hart's-tongue)  
*Buddleja davidii* (Butterfly-bush)  
*Centranthus ruber* (Red Valerian)  
*Cymbalaria muralis* (Ivy-leaved Toadflax)  
*Erigeron karvinskianus* (Mexican Fleabane)  
*Parietaria judaica* (Pellitory-of-the-wall)

**Photograph 4.4. Marsh/ tall-herb swamp plants by river (yellow arrows)**





## 5 ECOLOGICAL EVALUATION OF QUAY WALL VEGETATION COMMUNITIES

### 5.1 Algal zone

No affinity with any Annex I habitat. Likely to be able to rapidly recolonise new/ disturbed substrates. Local (low) ecological value.

### 5.2 Aquatic bryophyte zone

The quay walls support an aquatic bryophyte flora with some species typical of Floating River Vegetation (3260) Annex I habitat: *Cinclidotus fontinaloides*, *Fontinalis antipyretica*, *Platyhypnidium riparioides* and *Sciuro-hypnum plumosum*. However, the presence of these species alone does not indicate 3260 habitat. The review in Section 3 shows that bryophyte dominated 3260 typically has one or more of the following characteristics:

- Upland eroding rivers with oligotrophic water and high flow.
- High cover and diversity of bryophytes.
- Boulders present in-channel.
- Presence of one or more rare or protected species.
- Presence of at least one species within *Ranunculus* (subgenus *Batrachium*).

The river section within the survey is a lowland depositing river. It does not have the high, variable, flow or structure (in-channel and marginal boulders) of bryophyte dominant upland eroding rivers. No rare or protected bryophyte species were recorded from the quay walls within the survey area. Although full access was not possible for the survey, the rare/ protected bryophyte species recorded from within the Lower River Shannon SAC (and which indicate the 'bryophyte-rich sub-type) are not highly likely to occur in this habitat. Bryophytes are of low cover in the overall channel as they are restricted to the quay walls. Therefore, the aquatic bryophyte zone is not considered to be an example of the Annex I habitat 3260. However, it does have affinity with this habitat, is part of an SAC river system (for which 3260 is a Qualifying Interest) and functions as an ecological link/ corridor through the city in this part of the SAC. County ecological value.

### 5.3 Dry wall bryophyte zone

The bryophytes present in the dry wall areas do not have affinity with any Annex I habitat and no rare or protected bryophyte species were recorded. They do however form an important part of the urban biodiversity in this area. Local (high) ecological value.

### 5.4 Tall-herb swamp vascular plant zone

The tall-herb swamp vegetation present on the walls and exposed mud in shallow areas by the walls has affinity with the Annex I habitat 6430 *Hydrophilous tall herb fringe communities of plains and of the montane to alpine levels*. At least five indicator species from this habitat are present: *Angelica sylvestris*, *Filipendula ulmaria*, *Lythrum salicaria*, *Mentha aquatica* and *Myosotis scorpioides*. It is mostly a narrow strip or scattered plants and does not cover a significant area. However, it does have affinity to this habitat and is typical of river marginal habitat in less modified sections of the riverbank to the north and south of the city and elsewhere within the Lower River Shannon SAC. It forms an important part of the urban biodiversity in this area. The Annex I habitat 6430 is not a Qualifying Interest for the Lower River Shannon SAC. Local (high) ecological value.

## 6 RECOMMENDATIONS

Works are proposed to the quay walls associated with the King's Island Flood Relief Scheme. The works should be designed to maintain the distribution of habitats of ecological value, maintain urban biodiversity and to maintain species diversity and distribution throughout this area of the SAC. A number of recommendations for each zone are summarised below:

### 6.1 Algal zone

- No recommendations. Vegetation likely to quickly recolonise any disturbed/ replaced sections of quay wall.

### 6.2 Aquatic bryophyte zone

- Retain where possible and maintain distribution and species diversity throughout area.
- If not possible to preserve all current areas of aquatic bryophyte vegetation, then the aim should be to retain some areas of bryophytes (of all species) throughout the survey area and to ensure that any replaced stonework is suitable for bryophyte recolonisation.
- Bryophytes do not have roots and attach to stonework/ mortar by rhizoids (small root-like structures). This means that they can quickly recolonise surfaces where the surface is suitable (e.g. not too smooth). Any replaced stonework should be of a similar texture to the existing stone to promote re-establishment of the aquatic bryophyte flora.
- If some stonework needs to be removed, then the species are likely to survive temporary removal and replacement.
- The bryophytes are present both on the stonework and on the mortar between the stones. If the mortar is being replaced, then retain the bryophytes on the stonework. If the stonework is being cleaned, then maintain some bryophytes on the mortar.

### 6.3 Dry wall bryophyte zone

- Retain where possible and maintain distribution and species diversity throughout area.
- Ensure that any new stonework has a similar texture to the present stonework to ensure rapid re-colonisation of bryophytes on any new surfaces.
- Stonework with bryophytes present can be removed and replaced if required.

### 6.4 Tall-herb swamp vascular plant zone

- Retain where possible and maintain distribution and species diversity throughout area.
- Retain suitable niches at the river edge (raised, shallow areas exposed at low tide) and areas within the stonework which are suitable for vascular plant growth. This will enable rapid recolonisation of any disturbed/ repaired/ replaced stonework and other substrates.

## REFERENCES

- Blockeel, T.L., Bosanquet, S.D.S. Bosanquet, Hill, M.O. and Preston, C.D. (2014a). *Atlas of British and Irish bryophytes*. Volume 1. British Bryological Society (Pisces Publications, Newbury).
- Blockeel, T.L., Bosanquet, S.D.S. Bosanquet, Hill, M.O. and Preston, C.D. (2014b). *Atlas of British and Irish bryophytes*. Volume 2. British Bryological Society (Pisces Publications, Newbury).
- CIEEM (2019). *Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater, Coastal and Marine*. Version 1.1. Chartered Institute of Ecology and Environmental Management, Winchester.
- EC (2007). *Interpretation Manual of European Union Habitats - EUR27*. European Commission.
- Fossitt, J.A. (2000). *A guide to habitats in Ireland*. Heritage Council.
- Hatton-Ellis, T.W. & Grieve, N. (2003). *Ecology of Watercourses Characterised by Ranunculion fluitantis and Callitricho-Batrachion Vegetation*. Conserving Natura 2000 Rivers Ecology Series No. 11. English Nature, Peterborough.
- JNCC. Background information on 3260 Rivers with floating vegetation often dominated by watercrowsfoot Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation and SAC site selection. Website accessed ug 2016. <http://jncc.defra.gov.uk/protectedsites/sacselection/species.asp?FeatureIntCode=H3260>
- JNCC (2014). *Common Standards Monitoring Guidance for Rivers*. Version January 2014, Updated from March 2005. Joint Nature Conservation Committee (published online).
- Kelleher, C. (2011). Floating river vegetation (EU Habitat code 3260) – a review of the habitat description and its distribution in Ireland. Unpublished report for National Parks & Wildlife Services. Department of Arts, Heritage and the Gaeltacht, Dublin, Ireland.
- Hill, M.O., Blackstock, T. H., Long, D.G, Rothero G.P. (2008) *A checklist and census catalogue of British and Irish Bryophytes*. British Bryological Society.
- Lockhart, N., Hodgetts, N. & Holyoak, D. (2012) *Ireland Red List No.8: Bryophytes*. National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht, Dublin, Ireland.
- NPWS (2019). NPWS (2019). The Status of EU Protected Habitats and Species in Ireland. Volume 2: Habitat Assessments. Unpublished NPWS report. Edited by: Deirdre Lynn and Fionnuala O'Neill
- NPWS (2013). *The Status of EU Protected Habitats and Species in Ireland*. Habitat Assessments Volume 2. Version 1.0. Unpublished Report, National Parks & Wildlife Services. Department of Arts, Heritage and the Gaeltacht, Dublin, Ireland.
- NPWS (2012). *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. National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht.
- Stace, C.A. (2019). *New Flora of the British Isles*. 4<sup>th</sup> Edition. C&M Floristics, Stowmarket, UK.
- Weekes, L., Kaçki, Z., Fitzpatrick, U., Kelly, F., Matson, R. and Kelly-Quinn, M. (2018). An Irish national vegetation classification system for aquatic river macrophytes. *Applied Vegetation Science* 21(2):322-340.
- White, J. and Doyle, G.J. (1982). The vegetation of Ireland: a catalogue raisonné. *Journal of Life Science, Royal Dublin Society* 3: 289-368.
- Willby, N., Pitt, J.A. and Phillips, G. (2012). *The ecological classification of UK rivers using aquatic macrophytes*. Report SC010080/R1 for Environment Agency, Bristol, UK.

**JBA**  
consulting

**Offices at**  
Dublin  
Limerick

Registered Office  
**24 Grove Island**  
**Corbally**  
**Limerick**  
**Ireland**

**t: +353 (0) 61 345463**  
**e: [info@jbaconsulting.ie](mailto:info@jbaconsulting.ie)**

**JBA Consulting Engineers  
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**Registration number 444752**

