Russell Environmental and Sustainability Services Limited

PART 2

NATURA IMPACT STATEMENT

IN SUPPORT OF STAGE 2 APPROPRIATE ASSESSMENT

Student Accommodation, Cork Road, Waterford

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1.0 Introduction

In preparation for the planning application for Student Accommodation, Cork Road, Waterford this Natura Impact Statement (NIS) has been produced to determine the likelihood of any significant effects to the Lower River Suir SAC (and downriver River Barrow and River Nore SAC), due to the hydrological connectivity of the SAC with the development site. The River Suir is situated approximately 2.31km from the site. A section of John's River is within the boundary of the site, which flows directly into the River Suir. The site is also close to Kilbarry Bog proposed Natural Heritage Area (pNHA).

1.1 Background

A Screening for Appropriate Assessment was prepared for the Student Accommodation development.

The screening assessment concluded as follows:
In conclusion, there is a potential pathway for direct risk from emissions from foreign particulate matter/hydrocarbons/pollution during the construction phase and hydrocarbons from the operation phase into the European Sites due to the proximity of the John's River which discharges directly into the Lower River Suir SAC and down river into the River Barrow and River Nore SAC. Therefore, a Stage 2 Appropriate Assessment is required as the aforementioned SACs cannot be 'screened out'.

Table 1 below provides a screening summary and identifies the potential impacts that could not be excluded at screening stage.

European Site	Distance from Proposed Development	Screening Summary
Lower River Suir SAC IE0002137 River Barrow and River Nore SAC IE002162	2.31km 9.09km	There will be no direct impacts as the site of the proposed development is located approximately 2.31km metres from the SAC. Potential pathways for indirect impact on the Annex species of the Lower River Suir SAC and River Barrow and River Nore SAC, have been identified in the form of emissions to surface water which has the potential to affect the supporting habitats of the species downstream of the proposed development site. Consequently, the potential for indirect impacts on the Annex species associated with the SAC requires further assessment. No direct pathway for significant effect was identified at screening stage with regard to any of the SAC Qualifying Interests.

Table 1 Natura 2000 Sites that have been 'Screened In'

1.2 Legislative Context

In light of the finding of the screening report for the student Accommodation development at Cork Road, an NIS has now been prepared for the development, having regard to the European Commission guidance document Assessment of Plans and Projects Significantly affecting Natura 2000 Sites: Methodological Guidance on the provisions of Article 6(3) and 6(4) of the Habitats Directive 92/43/EEC (EC, 2001) and the Department of the Environment's Guidance on the Appropriate Assessment of Plans and Projects in Ireland (December 2009, amended February 2010).

1.2.1 EU Habitats Directive

Article 6(1) and article 6(2) of Council Directive 92/43/EEC of 21st May 1992 on the conservation of natural habitats and of wild fauna and flora aims to promote the maintenance of biodiversity. It forms the cornerstone of Europe's nature conservation policy with the Birds Directive and establishes the EU wide Natura 2000 ecological network of protected areas, safeguarded against potentially damaging developments." (EEC, 1992).

Article 6(1) and 6(2) are concerned with Special Areas of Conservation (SAC), whereby Member States are required to establish necessary conservation measures and appropriate statutory measures to ensure the protection of natural habitat types in Annex I and the species in Annex II present on the sites. This includes the avoiding the deterioration of natural habitats as well as the disturbance of any species included in Annex II (EHLG, 2009, p18).

The focus of Appropriate Assessment (AA) is targeted specifically on Natura 2000 sites and their conservation objectives. Articles 6(3) and 6(4) of the Habitats Directive place strict legal obligations on Member States, with the outcomes of AA fundamentally affecting the decisions that may lawfully be made. Articles 6(3) and 6(4) also detail the procedures to be completed when a development is likely to or has affected a Natura 2000 site. The Lower River Suir and River Barrow and River Nore are both SACs and as thus are Natura 2000 sites (EHLG, 2009, p18).
Articles 6(3) and 6(4) are detailed as follows:

6(3) – Any plan or project not directly connected with or necessary to the management of the site but likely to have a significant effect thereon, either individually or in combination with other plans or projects, shall be subject to appropriate assessment of its implications for the site in view of the site's conservation objectives. In the light of the conclusions of the assessment of the implications for the site and subject to the provisions of paragraph 4, the competent national authorities shall agree to the plan or project only after having ascertained that it will not adversely affect the integrity of the site concerned and, if appropriate, after having obtained the opinion of the general public.

6(4) – If, in spite of a negative assessment of the implications for the site and in the absence of alternative solutions, a plan or project must nevertheless be carried out for imperative reasons of overriding public interest, including those of a social or economic nature, the Member State shall take all compensatory measures necessary to ensure that the overall coherence of Natura 2000 is protected. It shall inform the Commission of the compensatory measures adopted. Where the site concerned hosts a priority natural habitat type and/or a priority species, the only considerations which may be raised are those relating to human health or public safety, to beneficial consequences of primary importance for the environment or, further to an opinion from the Commission, to other imperative reasons of overriding public interest (EHLG, 2009, p18).

1.2.2 Stage 1 and 2 Appropriate Assessment

There are four stages involved in completing an AA. Stages 1-2 deal with the main requirements for assessment under Article 6(3). Stage 3 may be part of Article 6(3) or may be a necessary precursor to Stage 4. Stage 4 is the main derogation step of Article 6(4).

Stage 1. Screening for Appropriate Assessment Screening is the process that addresses and records the reasoning and conclusions in relation to the first two tests of Article 6(3):

i) whether a plan or project is directly connected to or necessary for the management of the site.
ii) whether a plan or project, alone or in combination with other plans and projects, is likely to have significant effects on a Natura 2000 site in view of its conservation objectives.

If the effects are deemed to be significant, potentially significant, or uncertain, or it the screening process becomes overly complicated, then the process must proceed to Stage 2 (AA) (EHLG, 2009, p27).

Stage 2 for Appropriate Assessment

This stage considers whether the plan or project, alone or in combination with other project or plans, will have adverse effects on the integrity of a Natura 2000 site, and includes any mitigation measures to avoid, reduce or offset negative effects. The proponent of the plan or project will be required to submit a Natura Impact Statement i.e., the report of targeted professionals scientific examination of the plan or project and the relevant Natura 2000 sites, to identify and characterise any possible implications for the site in view of the conservation objectives, taking into account of in combination effects (EHLG, 2009, p28).

As the site contains a hydrological link to SACs, an Appropriate Assessment (Stage 2) is required to determine the effect that the proposed development will have on the Annex I habitat and Annex II species as per Article 6(3) and 6(4) that detail the procedures to be completed when a development is likely to or has affected a Natura 2000 site.

1.2 Appropriate Assessment Methodology

The information contained in this NIS is designed to allow the Competent Authority to assess:
1) the implications of the project, alone or in combination with other plans and projects, for a European Site in view of its Conservation Objectives.
2) whether there will be any adverse effects on the integrity of a European Site.

Firstly, in Section 2 of the report, the proposed development is fully described.

Following on from this in Section 2.5, the results of the desk and field surveys that were undertaken are provided to provide all necessary details of the ecological baseline conditions at the site of the proposed development.

The interaction of the proposed development on the baseline environment is then considered in the context of potential effects thereon. This is undertaken with particular reference to the potential for the proposed development to result in adverse effects on the integrity of any European Site.

In Section 3, the Qualifying Interests and Conservation Objectives of the "screened in" European site are described, with subsequent identification of potential pathways for effects on each individual Qualifying Interest. Where potential pathways for effects are identified, the potential for adverse effects on each Qualifying Interest is assessed with respect to the national level pressures and threats.

Where available, the site-specific attributes and targets, associated with the individual Qualifying Interest, are also assessed with regard to the proposed development taking into consideration best practice and design features.

The assessment of potential adverse effects follows the precautionary principle as detailed in Article 191 of the Treaty on the Functioning of the European Union (EU). It aims at ensuring a higher level of environmental protection through preventative decision-taking in the case of risk and underpins the Habitats Directive (EEC, 2019). The precautionary principle is the underlying concept of sustainable development which implies that prudent action be taken to protect the environment even in the absence of scientific certainty (EEC, 2019).

In Section 4 the preventative measures to avoid impact are detailed, in particular the direct and indirect impacts on the EU Site. The impact during the construction phase is considered and the mitigation measures are proposed.

Following the assessment of potential adverse effects on a European Site resulting from the project itself, a further assessment of the potential for effects when the project is considered cumulatively and in combination with other proposed developments is made in Section 5.

Finally in Section 6, a concluding statement is made. This includes a summary of the results of the assessment and the potential adverse effects on the integrity of any European Site (limited to the Conservation Objectives of the site) (EEC, 2019).

The information contained in this report will allow the Competent Authority to determine that the proposed development will not adversely affect the integrity of any European Site.

1.4 Author of Report

Russell Environmental and Sustainability Services Ltd. were contracted by Noel Frisby Construction Ltd. to complete a Natura Impact Statement. This was in preparation for the planning application for the student Accommodation development at Cork Road. John's River is on the site which flows into the Lower River Suir SAC IE0002137 (which in turn flows into the River Barrow and River Nore SAC IE002162) and therefore, it was deemed necessary to prepare an NIS based on the Stage 1 Screening. This is because the site contains a hydrological link to the SACs. This site was surveyed by ecologists from RESS Ltd. on 1st October 2022, 22nd February 2023, 8th of April 2023 and the 22nd of June 2023. The conditions were dry on all visits and there were no constraints to the survey.

2.0 Site Description and Baseline Information

2.1 Description of the Development

Permission is being sought for the following Large-Scale Residential Development (LRD) comprising of the construction of a student accommodation development which will consist of the construction of 85 no. student accommodation apartments (ranging in size from 5-bed apartments to 8-bed apartments) comprising a total of 582 no. bed spaces in 4 no. blocks ranging in height from 4-6 storeys, with student amenity facilities including 1 no. retail/cafe unit, communal areas, laundry room, reception, student and staff facilities, storage, ESB substation/switch room, bin and general stores and plant rooms. The development also includes the provision of landscaping and amenity areas including a central courtyard space, public realm/plaza (fronting on to the Cork Road), the provision of a set down area, 1 no. vehicular access point onto Ballybeg Drive, car and bicycle parking, footpaths, signage, boundary treatment, pedestrian and cycle improvements to Lacken Road (including a pedestrian crossing) and all ancillary development including pedestrian/cyclist facilities, lighting, drainage (including 2 no. bio retention ponds), landscaping, boundary treatments and plant including PV solar at roof level.

2.2 Baseline Ecology of the Site

The Qualifying Interest (QI) species and habitats associated with the Lower River Suir SAC, for which potential pathways for impact require further assessment, are detailed in Table 2 and for the River Barrow and River Nore SAC in Table 3. The QI for the River Barrow and River Nore SAC have been considered as the River Suir flows into this SAC down river near Cheekpoint at approximately 9.09km away.

Habitat Code	Habitat	Potential Pathway for Impacts	Potential for Significant Effects
1330	Atlantic Salt Meadows	No	Significant distance from the site and therefore geographical separation, so no potential pathway for impacts
1410	Mediterranean Salt Meadows	No	Not identified in the Little Island Saltmarsh Monitoring Project, which is the nearest Saltmarsh habitat
3260	Floating River Vegetation	No	Upriver, therefore geographical separation, so no potential pathway for impacts
6430	Hydrophilous Tall Herb Communities	No	Significant distance from the site and therefore geographical separation, so no potential pathway for impacts Not in the immediate vicinity of the site, but may be present in the vegetation

			adjacent to the River Suir
91A0	Old Oak Woodlands	No	Significant distance from the site and therefore geographical separation, so no potential pathway for impacts
91E0	Alluvial Forests*	No	Significant distance from the site and therefore geographical separation, so no potential pathway for impacts
91J0	Yew Woodlands*	No	Significant distance from the site and therefore geographical separation, so no potential pathway for impacts
Species Code	**Species**	**Potential Pathway for Impacts**	**Potential for Significant Effects**
1029	Freshwater Pearl Mussel (*Margaritifera margaritifera*)	No	Upriver, therefore geographical separation, so no potential pathway for impacts
1092	White-clawed Crayfish (*Austropotamobius pallipes*)	No	Upriver, therefore geographical separation, so no potential pathway for impacts
1095	Sea Lamprey (*Petromyzon marinus*)	Possible	Suitable habitat for these species, so potential pathway for impacts
1096	Brook Lamprey (*Lampetra planeri*)	No	Only found in freshwater. Located upriver and significant distance from the site and therefore geographical separation, so no potential pathway for impacts
1099	River Lamprey (*Lampetra fluviatilis*)	Possible	Suitable habitat for these species, so potential pathway for impacts
1103	Twaite Shad (*Alosa fallax*)	Possible	Suitable habitat for these species, so potential pathway for impacts
1106	Atlantic Salmon (*Salmo salar*)	Possible	Suitable habitat for these species, so potential pathway for impacts
1355	Otter (*Lutra lutra*)	Yes	In River Suir where John's River discharges and within John's River itself, thus potential pathway for impact

Table 2 Qualifying habitats and species of the Lower River Suir SAC considered for impacts and effects (NPWS, 2017, Biodiversity Ireland, 2023).

Habitat Code	**Habitat**	**Potential Pathway for Impacts**	**Potential for Significant Effects**
1130	Estuaries	No	Significant distance from the site and therefore geographical separation, so no potential pathway for impacts
1140	Tidal Mudflats and Sandflats	No	Significant distance from the site and therefore geographical

			separation, so no potential pathway for impacts
1170	Reefs	No	On the Wexford coast across the River Suir, therefore geographical separation, so no potential pathway for impacts
1330	Atlantic Salt Meadows	No	Upriver, therefore geographical separation, so no potential pathway for impacts
1410	Mediterranean Salt Meadows	No	Upriver, therefore geographical separation, so no potential pathway for impacts
3260	Floating River Vegetation	No	Upriver, therefore geographical separation, so no potential pathway for impacts
4030	Dry Heath	No	Upriver, therefore geographical separation, so no potential pathway for impacts
6430	Hydrophilous Tall Herb Communities	No	Significant distance from the site and therefore geographical separation, so no potential pathway for impacts
7220	Petrifying Springs*	No	Upriver, therefore geographical separation, so no potential pathway for impacts
91A0	Old Oak Woodlands	No	Significant distance from the site and therefore geographical separation, so no potential pathway for impacts
91E0	Alluvial Forests*	No	Upriver, therefore geographical separation, so no potential pathway for impacts
Species Code	**Species**	**Potential Pathway for Impacts**	**Potential for Significant Effects**
1016	Desmoulin's Whorl Snail (*Vertigo moulinsiana)*	No	Significant distance from the site and therefore geographical separation, so no potential pathway for impacts
1029	Freshwater Pearl Mussel (*Margaritifera margaritifera*)	No	Significant distance from the site and therefore geographical separation, so no potential pathway for impacts
1092	White-clawed Crayfish (*Austropotamobius pallipes*)	No	Significant distance from the site and therefore geographical separation, so no potential pathway for impacts
1095	Sea Lamprey (*Petromyzon marinus*)	Possible	Suitable habitat for these species, so potential pathway for impacts
1096	Brook Lamprey (*Lampetra planeri*)	No	Only found in freshwater. Located upriver and significant distance

			from the site and therefore geographical separation, so no potential pathway for impacts
1099	River Lamprey (*Lampetra fluviatilis*)	Possible	Suitable habitat for these species, so potential pathway for impacts
1103	Twaite Shad (*Alosa fallax*)	Possible	Suitable habitat for these species, so potential pathway for impacts
1106	Atlantic Salmon (*Salmo salar*)	Possible	Suitable habitat for these species, so potential pathway for impacts
1355	Otter (*Lutra lutra*)	Yes	In John's River, thus potential pathway for impact
1421	Killarney Fern (*Trichomanes speciosum*)	No	Significant distance from the site and therefore geographical separation, so no potential pathway for impacts
1990	Nore Freshwater Pearl Mussel (*Margaritifera durrovensis*)	No	Significant distance from the site and therefore geographical separation, so no potential pathway for impacts

Table 3 Qualifying habitats and species of the River Barrow and River Nore SAC considered for impacts and effects (NPWS, 2011, Biodiversity Ireland, 2023).

2.2.1 Desk Study

The EPA provides the AA Geotool that is a database of protected sites and associated flow network for water courses within Ireland. The flow network identified that the John's River which is located within the site, flows directly into the Lower River Suir SAC (Figure 1).

The National Biodiversity Data Centre provides a national database of biological records from Ireland. The database was consulted with regard to all QI species records within the area where the proposed development is located and where John's River discharges into the River Suir. The only QI species recorded is Otter.

There are a number of records of Otter on John's River and where the river discharges into the River Suir as detailed in Table 4.

Grid Reference	Location	Dataset	Date Recorded
S613122	Adelphi Quay	MISE project of Waterford 2011-2015	2011
S612123	Marina River	Atlas of Mammals of Ireland 2010-2015	2011
S612124	Adelphi Quay	Atlas of Mammals of Ireland 2010-2015	2014. 2016 and 2017
S610119	Lombard Bridge	Atlas of Mammals of Ireland 2010-2015	2012
S608120	John's River	Atlas of Mammals of Ireland 2010-2015	2012
S607120	John's River	Atlas of Mammals of Ireland 2010-20	2012

Table 4 Records of Otter Lutra lutra in John's River and River Suir (Biodiversity Ireland, 2023).

There were no records for Sea Lamprey *Petromyzon marinus*, River Lamprey *Lampetra fluviatilis*, Twaite Shad *Alosa fallax*, Atlantic Salmon *Salmo salar* in the River Suir near to where John's River discharges, or further down river. However, the NBDC records are not up to date and the habitat that the River Suir provides is suitable for these species and therefore they have been evaluated in section 3.1.

2.2.2 Field Survey

Flora

The vegetation survey that took place was based on the Best Practice Guidance for Habitat Surveying and Mapping (Smith *et al*., 2011) whereby the habitats are classified according to Fossitt (2000). In addition, the habitats mapped were compared with the Qualifying Interests (QI) listed for the Lower River Suir SAC.

Both the common name and the Latin names have been provided for the main plant species identified and are detailed in Part 1 Section 2.6. The letter and number codes i.e., GA1 for *Improved grassland* are the standard codes for habitat classification in Ireland (Fossitt, 2000). The vegetation was also mapped to the habitats listed on Annex I/II of the E.U. Habitats Directive.

This site was surveyed by ecologists from RESS Ltd. on 1st October 2022, 22nd February 2023, 8th of April 2023 and the 22nd of June 2023. The conditions were dry on all visits and there were no constraints to the survey. The habitat map is located in Appendix i.

Within the site where the proposed Student Accommodation development is to be located, there were nine vegetation habitats identified (Fossitt, 2000). These were as follows:
WN5 Scattered Trees
WL2 Treeline
FW2 Depositing Lowland Stream
WS1 Scrub
ED2 Spoil and Bare Ground
ED3 Recolonising Bare Ground
FS2/WN5 Tall-Herb Swamp/Riparian Woodland Mosaic
GA2 Amenity Grassland
BL3 Artificial Surfaces
Himalayan honeysuckle *Leycesteria formosa* and Three-cornered leek *Alium Triquetrum* non-native invasive species are also present on the banks of the stream.

Fauna

The species of birds seen or heard on the site were Blackbird *Tardus merula*, House sparrow *Passer domesticus,* Woodpigeon *Columba palumbus,* Great tit *Parus major,* Blue tit *Cyanistes caeruleus,* Starling *Sturnus* vulgaris and Wren *Troglodytes troglodytes.*

There was no evidence, at the time of surveying, of Otter *Lutra lutra* activity (spraints, resting or breeding sites).
No rare species were recorded on the site.

3.0 Assessment of Likely Significant Effects on the European Sites

The Stage 1 AA Screening Report in Part 1 of this document 'screens in' the potential for significant effects on Lower River Suir SAC and River Barrow and River Nore SAC.

This Natura Impact Statement presents the data and information on the proposed Student Accommodation development and provides an analysis of the potential adverse effects on the above listed European Sites.

Potential adverse effects are assessed in view of best scientific knowledge, on the basis of objective information in relation to the proposed Student Accommodation development, including the proposed avoidance, reduction and preventive measures.

3.1 Identification of Potential Impacts on Lower River Suir SAC and the River Barrow and River Nore SAC

The Stage 1 Screening has identified the potential for the likely effects on the Lower River Suir SAC and down river in the River Barrow and River Nore SAC. Potential significant effects on the Qualifying Interest (QI) may arise in the form of emissions to surface water resulting from the construction and operation of the proposed Student Accommodation development. Indirect habitat loss or deterioration of Natura 2000 sites (including water quality) within the surrounding area can occur from the effects of run-off or discharge into the aquatic environment through impacts such as increased siltation, nutrient release and/or contamination.
There is connectivity with the development site and John's River which discharges into the Lower River Suir SAC (Figure 1). In addition, the River Barrow and River Nore SAC is c. 9.09km further down river of the point where John's River discharges to the River Suir. Therefore, there may be an indirect pathway for the receptors, the qualifying species and habitats of these European Sites, as detailed in Figure 2.

Figure 1 Hydrological links to the Lower River Suir SAC (EPA, 2024)

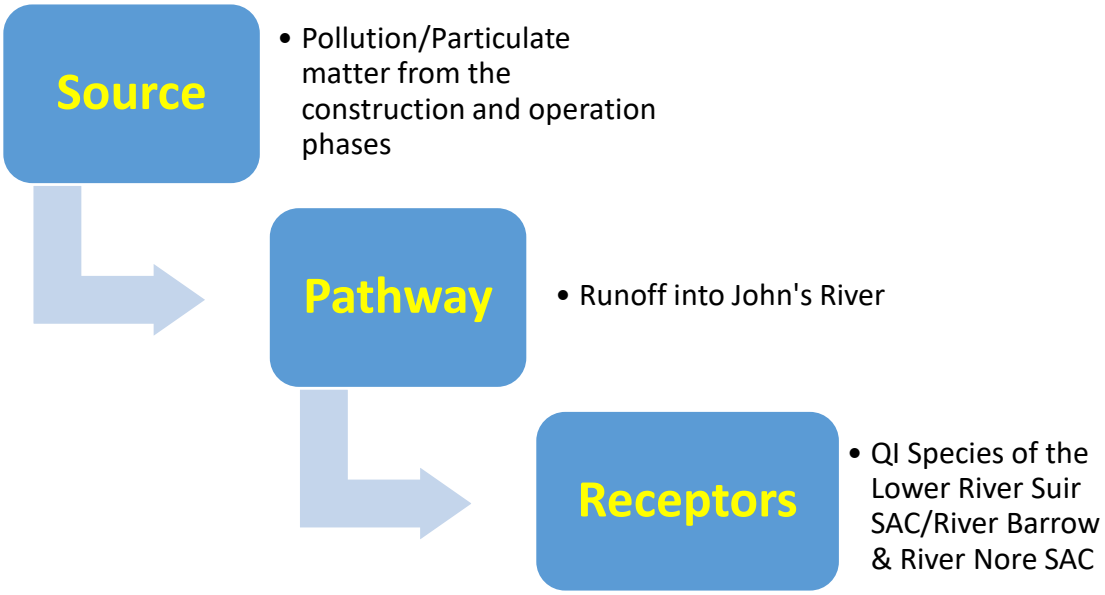

Figure 2 Source-Pathway-Receptor model for the site.

The qualifying interests for which pathways for potential impacts were identified are detailed in Table 2 and Table 3 and are listed below in Table 5 for convenience.
Potential significant effects on the QI may arise in the form of emissions from surface water resulting from the construction of the proposed development and post development from surface water runoff and storm water emitted from down pipes and over constructed surfaces (pavements and roads).

Species Code	European Site	Species	
1095	LRS SAC & RBRN SAC	Sea Lamprey (*Petromyzon marinus*)	To restore the favourable conservation condition of Sea Lamprey in Lower River Suir SAC/River Barrow and River Nore SAC
1099	LRS SAC & RBRN SAC	River Lamprey (*Lampetra fluviatilis*)	To restore the favourable conservation condition of River Lamprey in Lower River Suir SAC/River Barrow and River Nore SAC
1103	LRS SAC & RBRN SAC	Twaite Shad (*Alosa fallax*)	To restore the favourable conservation condition of Twaite Shad in Lower River Suir SAC/River Barrow and River Nore SAC
1106	LRS SAC & RBRN SAC	Atlantic Salmon (*Salmo salar*)	To restore the favourable conservation condition of Atlantic Salmon in Lower River Suir SAC/River Barrow and River Nore SAC
1355	LRS SAC	Otter (*Lutra lutra*)	To maintain the favourable conservation condition of Otter in Lower River Suir SAC/River Barrow and River Nore SAC

Table 5 Qualifying interests for which there is a potential for impact or significant effect (LRS = Lower River Suir SAC, RBRN = River Barrow and River Nore SAC) (NPWS, 2011; NPWS, 2017; Biodiversity Ireland, 2023).

3.1.1 Water Framework Directive

The WFD is included under the objectives of Waterford City and Council Development Plan 2022-2028 as detailed below:

WQ 01 Water Framework Directive and associated legislation
We will contribute towards, as appropriate, the protection of existing and potential water resources, and their use by humans and wildlife, including rivers, streams, wetlands, the coastline, groundwater and associated habitats and species in accordance with the requirements and guidance in the EU Water Framework Directive 2000 (2000/60/EC), the European Union (Water Policy) Regulations 2003 (as amended), the European Communities Environmental Objectives (Surface Waters) Regulations 2009 (as amended), the Groundwater Directive 2006/118/EC and the European Communities Environmental Objectives (groundwater) Regulations 2010 (as amended) and other relevant EU Directives, including associated national legislation and policy guidance (including any superseding versions of same). To support the application and implementation of a catchment planning and management approach to

development and conservation, including the implementation of Sustainable Drainage System techniques for new development.

WQ 02 Achieving High/ Good Water Quality Status
In order to maintain water quality at high status and a return to good status for rivers that are not meeting this threshold at present we will:

- Provide for the efficient and sustainable use and development of water resources and water services infrastructure.
- Manage and conserve water resources in a manner that supports a healthy society, economic development requirements and a cleaner environment.
- Ensure that all development does not negatively impact on water quality and quantity, including surface water, ground water, designated source protection areas, river corridors and associated wetlands, estuarine waters, coastal and transitional waters.
- Ensure new development complies with the relevant EPA Code of Practice: Wastewater Treatment and Disposal Systems Serving Single Houses (2009) or any amendments thereto.
- Screen planning applications according to their Water Framework Directive status and have regard to their status and objectives to achieve 'good' status or protect and improve 'high or good status'. A catchment-based approach shall be applied to the assessment of planning applications which may impact on water quality, and to ensure that the development would not result in a reduction in the water quality status of a water body in that catchment.

Hence this legislation is relevant in relation to the water quality of John's River and the River Suir into which it discharges. Therefore, measures must be put in place to ensure that the development in either the construction phase or operation phase does not negatively impact on the water quality of these two rivers.
There were five qualifying species of the two European Sites where there is the potential for indirect impacts. These are considered in further detail below.

3.1.2 Sea Lamprey *Petromyzon marinus*

Sea lamprey *Petromyzon marinus* where not recorded in the Biodiversity Ireland records for the portion of the River Suir in the vicinity of the proposed development site (or down river). However, these records are not up to date. As the lifecycle of this species includes both a marine and a freshwater phase, hence sea lamprey may be occupying the portion of the River Suir in the vicinity of the site and therefore the potential impacts to these three species have been covered in this report (NPWS, 2019b). With reference to Table 6, there are no pressures or threats that relate to the proposed development.

8 Main pressures and threats		
8.1 Characterisation of pressures/threats		
a) Pressure/threat	b) Ranking of pressure/threat *Indicate whether the pressure/threat is of:* *H = high importance (maximum of 5 entries for pressures and 5 for threats)* *M = medium importance*	
	Pressure	**Threat**
List a maximum of 10 pressures and a maximum of 10 threats using code list provided in the Reference portal	**D02** Hydropower (dams, weirs, run-off-the-river), including infrastructure (H) **N03** Increases or changes in precipitation due to climate change (H) **A19** Application of natural fertilisers on agricultural land (M) **A20** Application of synthetic (mineral) fertilisers on agricultural land (M) **A31** Drainage for use as agricultural land (M) **G01** Marine fish and shellfish harvesting (professional, recreational) causing reduction of species/prey populations (M) **Xo** Threats and pressures from outside the Member State (M)	**D02** Hydropower (dams, weirs, run-off-the-river), including infrastructure (H) **N03** Increases or changes in precipitation due to climate change (H) **A19** Application of natural fertilisers on agricultural land (M) **A20** Application of synthetic (mineral) fertilisers on agricultural land (M) **A31** Drainage for use as agricultural land (M) **G01** Marine fish and shellfish harvesting (professional, recreational) causing reduction of species/prey populations (M) **Xo** Threats and pressures from outside the Member State (M) **N01** Temperature changes (e.g. rise of temperature & extremes) due to climate change (M) **N02** Droughts and decreases in precipitation due to climate change (M)

Table 6 Pressures and threats to Sea Lamprey (NPWS, 2019b, p288) H = High importance, M = Medium importance.

As detailed in Table 7, the overall trend in conservation status for this species is stable. However, the range, population, future prospects and overall assessment of conservation status are all bad. The habitat is considered inadequate and therefore mitigation measures are required to ensure that the proposed Student Accommodation development in both the construction and operation phase do not affect the water quality of the River Suir.

11 Conclusions	
Assessment of conservation status at end of reporting period	
11.1 Range	*Favourable (FV) / Inadequate (U1) / **Bad (U2)** / Unknown (XX)*
11.2 Population	*Favourable (FV) / Inadequate (U1) / **Bad (U2)** / Unknown (XX)*
11.3 Habitat for the species	*Favourable (FV) / **Inadequate (U1)** / Bad (U2) / Unknown (XX)*
11.4 Future prospects	*Favourable (FV) / Inadequate (U1)/ **Bad (U2)** / Unknown (XX)*
11.5 Overall assessment of Conservation Status	*Favourable (FV) / Inadequate (U1) / **Bad (U2)** / Unknown (XX)*
11.6 Overall trend in Conservation Status	*Indicate the trend (qualifier) for FV, U1 and U2:* *improving / deteriorating / **stable** / unknown*

Table 7 Assessment of conservation status at the end of reporting period (NPWS, 2019b p292)

3.1.3 River lamprey *Lampetra fluviatilis*

River lamprey *Lampetra fluviatilis* occupy freshwater when they are young, but as adults they live as parasites on larger fish and occupy marine and estuarine habitats (NPWS, 2019b). Therefore, although not recorded in the Biodiversity Ireland records for this section of the River Suir (or down river), they may still be present in the vicinity of the development site.

Less is known about the conservation status of this species in terms of population, range or trend. The pressures and threats for this species detailed in Table 8 relate mostly to the adult stage and are not applicable for the proposed Student Accommodation development. However, the potential indirect risks in terms of water quality of runoff or storm water are the same as for Sea lamprey.

8 Main pressures and threats		
8.1 Characterisation of pressures/threats		
a) Pressure/threat	**b) Ranking of pressure/threat** *Indicate whether the pressure/threat is of:* *H = high importance (maximum of 5 entries for pressures and 5 for threats)* *M = medium importance*	
	Pressure	**Threat**
List a maximum of 10 pressures and a maximum of 10 threats using code list provided in the Reference portal	**D02** Hydropower (dams, weirs, run-off-the-river), including infrastructure (H) **N03** Increases or changes in precipitation due to climate change (H) **A19** Application of natural fertilisers on agricultural land (M) **A20** Application of synthetic (mineral) fertilisers on agricultural land (M) **A31** Drainage for use as agricultural land (M) **E03** Shipping lanes, ferry lanes and anchorage infrastructure (e.g. canalisation, dredging) (M)	**D02** Hydropower (dams, weirs, run-off-the-river), including infrastructure (H) **N03** Increases or changes in precipitation due to climate change (H) **A19** Application of natural fertilisers on agricultural land (M **A20** Application of synthetic (mineral) fertilisers on agricultural land (M) **A31** Drainage for use as agricultural land (M) **E03** Shipping lanes, ferry lanes and anchorage infrastructure (e.g. canalisation, dredging) (M) **N01** Temperature changes (e.g. rise of temperature & extremes) due to climate change (M)

Table 8 Main pressures and threats to River Lamprey (NPWS, 2019b, p323).

3.1.4 Twaite Shad *Alosa fallax*

Twaite Shad, spends most of its life in coastal and marine waters, but returns up-river to spawn and as for the previous species, although not recorded in the vicinity of the development site (or down river) in the Biodiversity Ireland records, they may still be present in the River Suir.

There are no pressures or threats detailed in Table 9 that apply to the proposed Student Accommodation development. However, the potential threat to water quality from surface water run-off during the construction and operation phases, still poses a potential, indirect impact and therefore mitigation measures are required to ensure that water quality is not affected. With reference to Table 10, the overall trend in conservation status is stable for this species (NPWS, 2019b).

8 Main pressures and threats		
8.1 Characterisation of pressures/threats		
a) Pressure/threat	b) Ranking of pressure/threat *Indicate whether the pressure/threat is of:* *H = high importance (maximum of 5 entries for pressures and 5 for threats)* *M = medium importance*	
	Pressure	**Threat**
List a maximum of 10 pressures and a maximum of 10 threats using code list provided in the Reference portal	**A19** Application of natural fertilisers on agricultural land (M) **A20** Application of synthetic (mineral) fertilisers on agricultural land (M) **D02** Hydropower (dams, weirs, run-off-the-river), including infrastructure (M) **E03** Shipping lanes, ferry lanes and anchorage infrastructure (e.g. canalisation, dredging) (M) **G01** Marine fish and shellfish harvesting (professional, recreational) causing reduction of species/prey populations (M) **G06** Freshwater fish and shellfish harvesting (recreational) (M) **G12** Bycatch and incidental killing (due to fishing and hunting activities) (M) **I02** Other invasive alien species (other than species of Union concern) (M) **N03** Increases or changes in precipitation due to climate change (M)	**A19** Application of natural fertilisers on agricultural land (H) **A20** Application of synthetic (mineral) fertilisers on agricultural land (H) **D02** Hydropower (dams, weirs, run-off-the-river), including infrastructure (M) **E03** Shipping lanes, ferry lanes and anchorage infrastructure (e.g. canalisation, dredging) (M) **G01** Marine fish and shellfish harvesting (professional, recreational) causing reduction of species/prey populations (M) **G06** Freshwater fish and shellfish harvesting (recreational) (M) **G12** Bycatch and incidental killing (due to fishing and hunting activities) (H) **I02** Other invasive alien species (other than species of Union concern) (M) **N01** Temperature changes (e.g. rise of temperature & extremes) due to climate change (M) **N03** Increases or changes in

Table 9 Main pressures and threats to Twaite Chad (NPWS, 2019b, p356).

11 Conclusions	
Assessment of conservation status at end of reporting period	
11.1 Range	*Favourable (FV) / Inadequate (U1) / **Bad (U2)** / Unknown (XX)*
11.2 Population	*Favourable (FV) / Inadequate (U1) / **Bad (U2)** / Unknown (XX)*
11.3 Habitat for the species	*Favourable (FV) / **Inadequate (U1)** / Bad (U2) / Unknown (XX)*
11.4 Future prospects	*Favourable (FV) / Inadequate (U1)/ **Bad (U2)** / Unknown (XX)*
11.5 Overall assessment of Conservation Status	*Favourable (FV) / Inadequate (U1) / **Bad (U2)** / Unknown (XX)*
11.6 Overall trend in Conservation Status	*Indicate the trend (qualifier) for FV, U1 and U2:* *improving / deteriorating / **stable** / unknown*

Table 10 Assessment of conservation status at the end of reporting period (NPWS, 2019b p360)

3.1.5 Atlantic Salmon *Salmo salar*

In Ireland, Atlantic Salmon *Salmo salar* usually spend their juvenile years up to 3 years in freshwater before moving to the sea, to return to their natal freshwater river for spawning (NPWS, 2019b). The River Suir provides a suitable habitat for this species, despite there being no Atlantic Salmon *Salmo salar* recorded in the catchment area. As already noted, the Biodiversity Ireland records are not recent and more recent data in the NPWS, 2019b, (p398) report state that the range and habitat status are favourable, but there is limited data on the population. However, the overall conservation status is considered stable (NPWS, 2019b).

8 Main pressures and threats		
8.1 Characterisation of pressures/threats		
a) Pressure/threat	**b) Ranking of pressure/threat** *Indicate whether the pressure/threat is of:* *H = high importance (maximum of 5 entries for pressures and 5 for threats)* *M = medium importance*	
	Pressure	**Threat**
List a maximum of 10 pressures and a maximum of 10 threats using code list provided in the Reference portal	**A26** Agricultural activities generating diffuse pollution to surface or ground waters (H) **G19** Other impacts from marine aquaculture, including infrastructure (H) **K05** Physical alteration of water bodies (H) **J01** Mixed source pollution to surface and ground waters (limnic and terrestrial) (H) **A25** Agricultural activities generating point source pollution to surface or ground waters (M) **B23** Forestry activities generating pollution to surface or ground waters (M) **D02** Hydropower (dams, weirs, run-off-the-river), including infrastructure (M) **G11** Illegal harvesting, collecting and taking (M) **G20** Abstraction of water, flow diversion, dams and other modifications of hydrological conditions for freshwater aquaculture (M) **L06** Interspecific relations (competition, predation, parasitism, pathogens) (M)	**A26** Agricultural activities generating diffuse pollution to surface or ground waters (H) **G19** Other impacts from marine aquaculture, including infrastructure (H) **K05** Physical alteration of water bodies (H) **N01** Temperature changes (e.g. rise of temperature & extremes) due to climate change (H) **A25** Agricultural activities generating point source pollution to surface or ground waters (M) **B23** Forestry activities generating pollution to surface or ground waters (M) **F12** Discharge of urban waste water (excluding storm overflows and/or urban run-offs) generating pollution to surface or ground water (M) **F28** Modification of flooding regimes, flood protection for residential or recreational development (M) **G11** Illegal harvesting, collecting and taking (M) **I02** Other invasive species (other than species of Union concern) (M)

Table 11 Main pressures and threats to Salmon (NPWS, 2019, p393).

With reference to Table 11, J01 Mixed source pollution, is the only pressure that may be an issue arising from pollution in surface water runoff during both the construction and operation phase of the proposed Student Accommodation development. Therefore, mitigation measures are required to be implemented to prevent this. Although the range and habitat for this species is favourable, the population, future prospects and overall conservation status are inadequate.

11 Conclusions	
Assessment of conservation status at end of reporting period	
11.1 Range	***Favourable (FV)*** */ Inadequate (U1) / Bad (U2) / Unknown (XX)*
11.2 Population	*Favourable (FV) /* ***Inadequate (U1)*** */ Bad (U2) / Unknown (XX)*
11.3 Habitat for the species	***Favourable (FV)*** */ Inadequate (U1) / Bad (U2) / Unknown (XX)*
11.4 Future prospects	*Favourable (FV) /* ***Inadequate (U1)*** */ Bad (U2) / Unknown (XX)*
11.5 Overall assessment of Conservation Status	*Favourable (FV) /* ***Inadequate (U1)*** */ Bad (U2) / Unknown (XX)*
11.6 Overall trend in Conservation Status	*Indicate the trend (qualifier) for FV, U1 and U2:* *improving / deteriorating /* ***stable*** */ unknown*

Table 12 Assessment of conservation status at the end of reporting period (NPWS, 2019b p398)

3.1.6 Otter *Lutra lutra*

The Favourable Conservation Status (FCS) target, based on 1980/81 survey findings, is 88% in SACs. Current range is estimated at 93.6% (Reid et al. 2013).

As identified in the 2019 Article 17 Report,

`*the current population is classed as stable and that there are no pressures or threats. The Range is extensive and stable. The population is also considered to be currently stable having recovered from previous decline. The habitat niche is occupied and is generally considered to be in good condition. No significant pressures or threats were identified"* (NPWS, 2019).

There are no direct pathways identified of impact from the proposed development that would impact on the Otter population of the John's River and the Lower River Suir SAC. However, there is an indirect impact on the food sources for this species, especially as they were recorded in John's River itself and as thus the water quality must be protected to not affect the favourable conservation status.

4.0 Preventative Measures to Avoid Impacts

The potential pathways for impacts on the various Special Conservation Interests of the Lower River Suir SAC and River Barrow and River Nore SAC are listed, in the sections below, and the measures employed in the design of the project to prevent any such impacts are also discussed.

These measures are designed to ensure that the proposed development does not prevent or obstruct any of the qualifying interests from reaching favourable conservation status as per Article 1 of the EU Habitats Directive.

A definition of Favourable Conservation Status is provided below:
"conservation status of a species means the sum of the influences acting on the species concerned that may affect the long-term distribution and abundance of its populations within the territory referred to in Article 2;
The conservation status will be taken as 'favourable' when:

- *Population dynamics data on the species concerned indicate that it is maintaining itself on a long-term basis as a viable component of its natural habitats, and*
- *The natural range of the species is neither being reduced nor is likely to be reduced for the foreseeable future, and*
- *There is, and will probably continue to be, a sufficiently large habitat to maintain its populations on a long-term basis.'*

As discussed in Section 3.1 the conservation status of Otter *Lutra lutra* and Atlantic Salmon *Salmo salar,* is considered as favourable. However, the conservation status of Twaite Shad *Alosa fallax* and Sea Lamprey *Petromyzon marinus* is considered as bad with reference to Article 17 Report (NPWS, 2019b).

4.1 Potential for Direct Impacts on European Sites

The proposed development site is located outside the boundary of European Sites.

No pathways for direct impacts as a result of the development on any of the QIs/SCIs of any European Site were identified.

4.2 Potential for Indirect Impacts on the European Sites

Emissions to surface water were identified as a potential indirect effect on the Qualifying Interests of the Lower River Suir SAC and possibly the River Barrow and River Nore SAC.

4.3 Construction Phase

Potential significant effects on the Qualifying Interests (QI) may arise in the form of emissions to surface water during the construction phase of the development.

Measures to protect water quality during the construction phase are described below.

4.4 Mitigation Measures

4.4.1 Construction Phase

Due to the elevations of the site, there is a potential likelihood of runoff into John's River, hence it is proposed that a berm be constructed along the top of the bank adjacent to John's River.
In addition, to the berm, geotextile netting will be staked as a fence and put in place on top of the berm to prevent further runoff.
The following are general best practice site measures that must be implemented:

Site based work

- Earth works and concrete works will take place during periods of low rainfall to reduce run-off and potential siltation of watercourses.
- During construction of the development good construction practices such as dust suppression on site roads and regular plant maintenance, will ensure minimal risk.
- The weather forecast will be checked prior to the pouring of the concrete and no such works will be undertaken when bad weather is forecast. Any works at any time when water levels that may cause inundation of the works area will be avoided.
- Concrete will not be poured at times when rain is predicted as this may lead to run off and over spillage.
- All plant and machinery will be serviced before being mobilised to site.
- No plant maintenance will be completed on site, any broken-down plant will be removed from site to be fixed.
- Refuelling will be completed in a controlled manner using drip trays at all times and shall not take place within 50m from a water course.
- Fuel containers will be stored within a secondary containment system, e.g., bunds for static tanks or a drip tray for mobile stores.
- Taps, nozzles or valves will be fitted with a lock system.
- Fuel and oil stores including tanks and drums will be regularly inspected for leaks and signs of damage. Drip-trays will be used for fixed or mobile plant such as pumps and generators in order to retain oil leaks and spills. Only designated trained operators will be authorised to refuel plant on site.
- Procedures and contingency plans will be set up to deal with emergency accidents or spills. An emergency spill kit with oil boom, absorbers etc. will be kept on-site for use in the event of an accidental spill.
- Concrete (including waste and wash down) will be contained and managed appropriately to prevent pollution of watercourses. Pouring will occur in the dry, with appropriate curing times (48 hours) before re-flooding.

- Mixer washings and excess concrete will not be discharged to water. If cement washings are to be discharged, they will first be held in a treatment facility in order to neutralise the pH and to settle out solids.

The contractor will assign a member of the site staff as the environmental officer with the responsibility for ensuring the environmental measures prescribed are adhered to. The following will be carried out by the appointed staff member.

- A checklist will be filled in on a weekly basis to show how the measures above have been complied with.
- A 'tool-box' talks shall be held with all construction employees to make them aware of their roles and responsibilities and the importance of no direct impact due to their work activities to the European sites.
- Any environmental incidents or non-compliance issues will immediately be reported to the project manager.
- The site manager will be continuously monitoring the works and will be fully briefed and aware of the environmental constraints and protection measures to be employed.

The works will be periodically monitored during the construction phase by a qualified ecologist. Following completion of the works, the ecologist will complete a final audit report to show how the works complied with the environmental provisions described in this document. This audit report will be forwarded to the WC&CC if required.

4.4.2 Operation Phase

With reference to the accompanying report from Malone O'Regan, a sustainable drainage scheme has been designed involving two interconnected retention ponds. These ponds will have choked flow and discharge into the adjacent stream known locally as the Lisduggan stream (John's River). The surface water will be collected and piped underground to the first pond closest to the development which will then discharge into the second pond. The second pond discharges to the Lisduggan stream via a hydro brake at a flow rate of 2 litres/second.

The purpose of this measure is to mimic natural drainage, which is now reduced due to the creation of man-made surfaces in the form of buildings and associated impermeable footpaths and roadways as part of the development. The proposed wetland retention ponds will intercept and delay the runoff, thus slowing it down to facilitate the settling out of any pollutants.

Furthermore, the retention ponds will be kept open allowing for evaporation of surface water and infiltration through the ground. The wetland will be planted with native species as detailed in the accompanying, that will serve not only to contain and act as soakage for any rain/storm water but will enhance the biodiversity in the area by providing a habitat similar to that found in Kilbarry Bog pNHA. As per Malone O' Regan's, accompanying engineering plans and report, the flow into the stream will be restricted to a discharge rate of 2 litres/second as requested by Waterford City and County Council.

Construction of the wetland will take place outside of breeding seasons for birds and mammals (August to February) and during periods of no/low rainfall.

In addition to the two ponds, permeable paving will be used to allow for further percolation to the ground over man-made surfaces.

The proposed Sustainable Drainage (SuDs) measures will also comply with the EU Water Framework Directive 2000 (2000/60/EC) and other legislation pertaining to surface water quality, as detailed in WCCC Development Plan 2022-2028.

4.5 Discussion of Proposed Preventative Measures to Avoid Impacts

Emissions to surface water were identified as a potential indirect effect on the Qualifying Interests of the European Site. The prevention measures outlined in the sections above are site specific and have been derived from scientific analysis of the development site. The proposed preventative measures, in view of best practice guidance and scientific knowledge, are appropriate to effectively avoid, reduce and remedy any impacts from runoff during construction and operation of the development.

The proposed development will not prevent the QIs/SCIs of the European Sites from achieving favourable conservation status in the future as defined in Article 1 of the EU Habitats Directive.

5.0 Cumulative/In-combination Impacts

The proposed development was considered in combination with other developments and activities in the area that could result in cumulative/in-combination impacts on European Sites.

Waterford County Development Plan was extended from 2011- 2017 to 2022-2028 with the amalgamation of Waterford County Council and Waterford City Council in 2014. This area has been zoned for development.

Close to the south of the site on the Lacken Road is an extensive development with proposed 12 Phases by Kilbarry Developments Ltd. Phases 1 and 2 have been or are in the process of construction and planning has been approved for Phases 3, 4, 5 and 6. Therefore, there is the potential for cumulative/in-combination effects on both the Lower River Suir SAC down stream of John's River and Kilbarry Bog pNHA. However, the documents provided for planning detail mitigation measures and a SuDs scheme, that if applied will not impact on the aforementioned sites. As a result, the cumulative/in-combination effects are minimised and thus there is no likely cumulative/in-combination effect on the European Sites.

In addition, a further development has gone for planning by Rio Real Properties Limited, planning Reference 2360285, also along the Lacken Road and closer to the proposed Student Accommodation site. This development has two phases and has the potential to create a cumulative/in-combination effect. However, the planning application for Phase 1 has considerations for mitigation measures to protect the SACs and a comprehensive SuDs scheme so that neither Kilbarry Bog nor the River Suir are impacted.

5.1 Cumulative/In-combination Impact Conditions

The potential cumulative/in-combination impacts of the proposed development were considered following research of known and likely plans and projects in the area and on the basis that the proposed development has been designed to avoid significant adverse impacts on the integrity of European Sites.

It is concluded that there will be no significant cumulative/in-combination impact on the ecology of the area as a result of the proposed development.

The biodiversity net loss/net gain has been considered in detail in the accompanying Ecological Impact Assessment.

6.0 Conclusion

This NIS has been prepared in accordance with the relevant provisions of the Habitats Directive, the Habitats Regulations and the Planning and Development Act (2000), as well as the relevant case law and current guidance.

It has demonstrated that, the proposed Student Accommodation development will not adversely affect the integrity of any European site.

During this assessment a pathway for potential impacts on the Qualifying Interests of the nearby European sites were identified. These did not include any direct impacts, but potential indirect pathways were identified. On this basis, mitigation measures to avoid the potential for any significant impact during the construction phase and during operation once the Student Accommodation development is complete, have been identified in Section 4.4.

It can be concluded that this development can be excluded from cumulative/in-combination effects, on the basis of objective scientific information. The project, individually or in combination with other plans or projects will not affect the integrity of any European Site.

This assessment has been undertaken on the basis of the best scientific knowledge in the field and the Precautionary Principle.

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Russell Environmental and Sustainability Services Limited

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APPENDICES

Appendix i


Habitat Map
N
R680
R680
Cork Road
80
0.00 0.01 0.01 0.03 0.04 0.06
Kilometers
Legend
WD5 Scattered Trees
WL2 Treeline
FW2 Depositing Lowland Stream
BL3 Artificial Surfaces
Boundary
WS1 Scrub
ED3 Recolonising Bare Ground
FS2/WN5 Tall-Herb Swamps/Riparian Woodland Mosaic
ED2 Spoil and Bare Ground
GA2 Amenity Grassland

Appendix ii

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National Parks and Wildlife Service

Conservation Objectives Series

Lower River Suir SAC 002137

An Roinn Ealaíon, Oidhreachta,
Gnóthaí Réigiúnacha, Tuaithe agus Gaeltachta

Department of Arts, Heritage,
Regional, Rural and Gaeltacht Affairs

National Parks and Wildlife Service,
Department of Arts, Heritage, Regional, Rural and Gaeltacht Affairs,

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Introduction

The overall aim of the Habitats Directive is to maintain or restore the favourable conservation status of habitats and species of community interest. These habitats and species are listed in the Habitats and Birds Directives and Special Areas of Conservation and Special Protection Areas are designated to afford protection to the most vulnerable of them. These two designations are collectively known as the Natura 2000 network.

European and national legislation places a collective obligation on Ireland and its citizens to maintain habitats and species in the Natura 2000 network at favourable conservation condition. The Government and its agencies are responsible for the implementation and enforcement of regulations that will ensure the ecological integrity of these sites.

A site-specific conservation objective aims to define favourable conservation condition for a particular habitat or species at that site.

The maintenance of habitats and species within Natura 2000 sites at favourable conservation condition will contribute to the overall maintenance of favourable conservation status of those habitats and species at a national level.

Favourable conservation status of a habitat is achieved when:

- its natural range, and area it covers within that range, are stable or increasing, and
- the specific structure and functions which are necessary for its long-term maintenance exist and are likely to continue to exist for the foreseeable future, and
- the conservation status of its typical species is favourable.

The favourable conservation status of a species is achieved when:

- population dynamics data on the species concerned indicate that it is maintaining itself on a long-term basis as a viable component of its natural habitats, and
- the natural range of the species is neither being reduced nor is likely to be reduced for the foreseeable future, and
- there is, and will probably continue to be, a sufficiently large habitat to maintain its populations on a long-term basis.

Notes/Guidelines:

1. The targets given in these conservation objectives are based on best available information at the time of writing. As more information becomes available, targets for attributes may change. These will be updated periodically, as necessary.
2. An appropriate assessment based on these conservation objectives will remain valid even if the targets are subsequently updated, providing they were the most recent objectives available when the assessment was carried out. It is essential that the date and version are included when objectives are cited.
3. Assessments cannot consider an attribute in isolation from the others listed for that habitat or species, or for other habitats and species listed for that site. A plan or project with an apparently small impact on one attribute may have a significant impact on another.
4. Please note that the maps included in this document do not necessarily show the entire extent of the habitats and species for which the site is listed. This should be borne in mind when appropriate assessments are being carried out.
5. When using these objectives, it is essential that the relevant backing/supporting documents are consulted, particularly where instructed in the targets or notes for a particular attribute.

Qualifying Interests

**** indicates a priority habitat under the Habitats Directive***

002137	Lower River Suir SAC
1029	Freshwater Pearl Mussel *Margaritifera margaritifera*
1092	White-clawed Crayfish *Austropotamobius pallipes*
1095	Sea Lamprey *Petromyzon marinus*
1096	Brook Lamprey *Lampetra planeri*
1099	River Lamprey *Lampetra fluviatilis*
1103	Twaite Shad *Alosa fallax fallax*
1106	Salmon *Salmo salar*
1330	Atlantic salt meadows (Glauco-Puccinellietalia maritimae)
1355	Otter *Lutra lutra*
1410	Mediterranean salt meadows (Juncetalia maritimi)
3260	Water courses of plain to montane levels with the Ranunculion fluitantis and Callitricho-Batrachion vegetation
6430	Hydrophilous tall herb fringe communities of plains and of the montane to alpine levels
91A0	Old sessile oak woods with *Ilex* and *Blechnum* in the British Isles
91E0	Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (Alno-Padion, Alnion incanae, Salicion albae)*
91J0	*Taxus baccata* woods of the British Isles*

Please note that this SAC is adjacent to River Barrow and River Nore SAC (002162). See map 2. The conservation objectives for this site should be used in conjunction with those for the adjacent site as appropriate.

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

NPWS Documents

Year :	1998
Title :	Conservation management of the white-clawed crayfish, *Austropotamobius pallipes*
Author :	Reynolds, J.D.
Series :	Irish Wildlife Manual No. 1
Year :	2006
Title :	Otter survey of Ireland 2004/2005
Author :	Bailey, M.; Rochford, J.
Series :	Irish Wildlife Manual No. 23
Year :	2006
Title :	Initiation of a monitoring program for the freshwater pearl mussel, *Margaritifera margaritifera*, in the Clodiagh River (Suir)
Author :	Ross, E.
Series :	Unpublished report to NPWS
Year :	2007
Title :	A survey of juvenile lamprey populations in the Corrib and Suir catchments
Author :	O'Connor, W.
Series :	Irish Wildlife Manual No. 26
Year :	2007
Title :	Supporting documentation for the Habitats Directive Conservation Status Assessment - backing documents. Article 17 forms and supporting maps
Author :	NPWS
Series :	Unpublished report to NPWS
Year :	2008
Title :	National survey of native woodlands 2003-2008
Author :	Perrin, P.M.; Martin, J.; Barron, S.; O'Neill, F.H.; McNutt, K.E.; Delaney, A.
Series :	Unpublished report to NPWS
Year :	2009
Title :	Saltmarsh monitoring project 2007-2008
Author :	McCorry, M.; Ryle, T.
Series :	Unpublished report to NPWS
Year :	2009
Title :	NS II freshwater pearl mussel sub-basin management plans: monitoring of the freshwater pearl mussel in the Clodiagh
Author :	Ross, E.
Series :	Unpublished report to NPWS
Year :	2009
Title :	NS II freshwater pearl mussel sub-basin management plans: fisheries survey. Stage 1 report
Author :	Paul Johnston Associates
Series :	Unpublished report to NPWS
Year :	2009
Title :	NS II freshwater pearl mussel sub-basin management plans: report on biological monitoring of surface water quality in Clodiagh (Waterford) catchment
Author :	Morgan, G.
Series :	Unpublished report to NPWS

Year :	2010
Title :	A provisional inventory of ancient and long-established woodland in Ireland
Author :	Perrin, P.M.; Daly, O.H.
Series :	Irish Wildlife Manual No. 46
Year :	2010
Title :	A technical manual for monitoring white-clawed crayfish (*Austropotamobius pallipes*) in Irish lakes
Author :	Reynolds, J., O'Connor, W., O'Keeffe, C.; Lynn, D.
Series :	Irish Wildlife Manual No.45
Year :	2010
Title :	Second draft Clodiagh freshwater pearl mussel sub-basin management plan (2009-2015). March 2010
Author :	NPWS
Series :	Unpublished document to the Department of Environment, Heritage and Local Government
Year :	2010
Title :	NS2 freshwater pearl mussel sub-basin management plans. Phytobenthos monitoring of the Clodiagh catchment, Co. Waterford (SERBD). June and July
Author :	Ní Chatháin, B.
Series :	Unpublished report to NPWS
Year :	2012
Title :	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 V1
Author :	NPWS
Series :	Conservation objectives supporting document
Year :	2013
Title :	National otter survey of Ireland 2010/12
Author :	Reid, N.; Hayden, B.; Lundy, M.G.; Pietravalle, S.; McDonald, R.A.; Montgomery, W.I.
Series :	Irish Wildlife Manual No. 76
Year :	2013
Title :	Irish semi-natural grasslands survey 2007-2012
Author :	O'Neill, F.H.; Martin, J.R.; Devaney, F.M.; Perrin, P.M.
Series :	Irish Wildlife Manual No. 78
Year :	2013
Title :	Results of monitoring survey of old sessile oak woods and alluvial forests
Author :	O'Neill, F.H.; Barron, S.J.
Series :	Irish Wildlife Manual No. 71
Year :	2013
Title :	Results of a monitoring survey of yew woodland
Author :	Cross, J.; Lynn, D.
Series :	Irish Wlidlife Manual No. 72
Year :	2013
Title :	The status of EU protected habitats and species in Ireland. Volume 3. Species assessments
Author :	NPWS
Series :	Conservation assessments

Year :	2016
Title :	Ireland Red List No. 10: Vascular Plants
Author :	Wyse Jackson, M.; FitzPatrick, Ú.; Cole, E.; Jebb, M.; McFerran, D.; Sheehy Skeffington, M.; Wright, M.
Series :	Ireland Red Lists series, NPWS
Year :	2017
Title :	Lower River Suir SAC (site code: 2137) Conservation objectives supporting document- coastal habitats V1
Author :	NPWS
Series :	Conservation objectives supporting document
Year :	2017
Title :	Survey and condition assessment of the freshwater pearl mussel, *Margaritifera margaritifera* (L.), in the Clodiagh River (Suir, Portlaw)
Author :	Ross, E.; Moorkens, E.; Killeen, I.
Series :	Unpublished report to NPWS

Other References

Year :	1898
Title :	Contributions towards a Cybele Hibernica. Second Edition
Author :	Colgan, N.; Scully, R.W.
Series :	Edward Ponsonby, Dublin
Year :	1982
Title :	Otter survey of Ireland
Author :	Chapman, P.J.; Chapman, L.L.
Series :	Unpublished report to Vincent Wildlife Trust
Year :	1988
Title :	The reproductive biology of freshwater mussels in Ireland, with observations on their distribution and demography
Author :	Ross, E.D.
Series :	Unpublished Ph.D. Thesis, National University of Ireland, Galway
Year :	1991
Title :	The spatial organization of otters (*Lutra lutra*) in Shetland
Author :	Kruuk, H.; Moorhouse, A.
Series :	Journal of Zoology, 224: 41-57
Year :	1992
Title :	Status of the freshwater pearl mussels *Margaritifera margaritifera* and *M. m. durrovensis* in the Nore, Barrow and Suir River tributaries, south-east Ireland
Author :	Moorkens, E.A.; Costello, M.J.; Speight, M.C.D.
Series :	Irish Naturalists' Journal, 24(3): 127-131
Year :	1996
Title :	Studies on the biology and ecology of *Margaritifera* in Ireland
Author :	Moorkens, E.
Series :	Unpublished Ph.D. thesis, University of Dublin, Trinity College.
Year :	1999
Title :	Diet of otters (*Lutra lutra*) on Inishmore, Aran Islands, west coast of Ireland
Author :	Kingston, S.; O'Connell, M.; Fairley, J.S.
Series :	Biology and Environment: Proceedings of the Royal Irish Academy, 99B: 173-182

Year :	2001
Title :	Aquatic plants in Britain and Ireland
Author :	Preston, C.D.; Croft, J.M.
Series :	Harley Books, Colchester
Year :	2002
Title :	Reversing the habitat fragmentation of British woodlands
Author :	Peterken, G.
Series :	WWF-UK, London
Year :	2002
Title :	A survey of the white-clawed crayfish (*Austropotamobius pallipes*) Lereboullet and of water quality in two catchments of eastern Ireland
Author :	Demers, A.; Reynolds, J.D.
Series :	Bulletin Francais de la Peche et de la Pisciculture, 367: 729-740
Year :	2003
Title :	Monitoring the river, sea and brook lamprey, *Lampetra fluviatilis*, *L. planeri* and *Petromyzon marinus*
Author :	Harvey, J.; Cowx, I.
Series :	Conserving Natura 2000 Rivers Monitoring Series No. 5. English Nature, Peterborough
Year :	2003
Title :	Ecology of watercourses characterised by Ranunculion fluitantis and Callitricho-Batrachion Vegetation
Author :	Hatton-Ellis, T.W.; Grieve, N.
Series :	Conserving Natura 2000 Rivers Ecology Series No. 11. English Nature, Peterborough
Year :	2003
Title :	Ecology of the allis and twaite shad
Author :	Maitland, P.S.; Hatton-Ellis, T.W.
Series :	Conserving Natura 2000 Rivers Ecology Series No. 3. English Nature, Peterborough
Year :	2003
Title :	Pondweeds of Great Britain and Ireland
Author :	Preston, C.D.
Series :	BSBI Handbook, No. 8, London
Year :	2003
Title :	Identifying lamprey. A field key for sea, river and brook lamprey
Author :	Gardiner, R.
Series :	Conserving Natura 2000 rivers, Conservation techniques No. 4. English Nature, Peterborough
Year :	2006
Title :	Otters - ecology, behaviour and conservation
Author :	Kruuk, H.
Series :	Oxford University Press
Year :	2006
Title :	The status of host fish populations and fish species richness in European freshwater pearl mussel (*Margaritifera margaritifera*) streams
Author :	Geist, J.; Porkka, M.; Kuehn, R.
Series :	Aquatic Conservation: Marine and Freshwater Ecosystems, 16: 251-266
Year :	2007
Title :	Evolutionary history of lamprey paired species *Lampetra fluviatilis* L. and *Lampetra planeri* Bloch as inferred from mitochondrial DNA variation
Author :	Espanhol, R.; Almeida, P.R.; Alves, M.J.
Series :	Molecular Ecology, 16: 1909-1924

Year :	2008
Title :	Poor water quality constrains the distribution and movements of twaite shad (*Alosa fallax fallax*, Lacepede, 1803) in the watershed of river Scheldt
Author :	Maas, J.; Stevens, M.; Breine, J.
Series :	Hydrobiologia, 602: 129-143
Year :	2008
Title :	Flora of County Waterford
Author :	Green, P.
Series :	The National Botanic Gardens of Ireland, Dublin
Year :	2010
Title :	Otter tracking study of Roaringwater Bay
Author :	De Jongh, A.; O'Neill, L.
Series :	Unpublished draft report to NPWS
Year :	2010
Title :	Addressing the conservation and rehabilitation of *Margaritifera margaritifera* populations in the Republic of Ireland within the framework of the habitats and species directive
Author :	Moorkens, E.
Series :	Journal of Conchology, 40: 339
Year :	2011
Title :	Comparison of field- and GIS-based assessments of barriers to Atlantic salmon migration: a case study in the Nore Catchment, Republic of Ireland
Author :	Gargan, P.G.; Roche, W.K.; Keane, S.; King, J.J.; Cullagh, A.; Mills, P.; O'Keeffe, J.
Series :	Journal of Applied Ichthyology, 27 (Suppl. 3): 66-72
Year :	2012
Title :	Rare and threatened bryophytes of Ireland
Author :	Lockhart, N.; Hodgetts, N.; Holyoak, D.
Series :	National Museums Northern Ireland
Year :	2013
Title :	Aspects of brook lamprey (*Lampetra planeri* Bloch) spawning in Irish waters
Author :	Rooney, S.M.; O'Gorman, N.M.; Green, F.; King, J.J.
Series :	Biology and Environment: Proceedings of the Royal Irish Academy, 113B(1): 13-25
Year :	2013
Title :	Management strategies for the protection of high status water bodies
Author :	Ní Chatháin, B.; Moorkens, E.; Irvine, K.
Series :	Strive Report Series No. 99. EPA, Wexford
Year :	2013
Title :	Interpretation manual of European Union habitats- Eur 28
Author :	European Commission- DG Environment
Series :	European Commission
Year :	2014
Title :	Assessing near-bed velocity in a recruiting population of the endangered freshwater pearl mussel (*Margaritifera margaritifera*) in Ireland
Author :	Moorkens, E.; Killeen, I.
Series :	Aquatic Conservation: Marine and Freshwater Ecosystems, 24(6): 853-862

Year :	2015
Title :	Water quality in Ireland 2010-2012
Author :	Bradley, C.; Byrne, C.; Craig, M.; Free, G.; Gallagher, T.; Kennedy, B.; Little, R.; Lucey, J.; Mannix, A.; McCreesh, P.; McDermott, G.; McGarrigle, M.; Ní Longphuirt, S.; O'Boyle, S.; Plant, C.; Tierney, D.; Trodd, W.; Webster, P.; Wilkes, R.; Wynne, C.
Series :	EPA, Wexford
Year :	2015
Title :	Behaviour of sea lamprey (*Petromyzon marinus* L.) at man-made obstacles during upriver spawning migration: use of telemetry to access efficacy of weir modifications for improved passage
Author :	Rooney, S.M.; Wightman, G.D.; O Conchuir, R.; King, J.J.
Series :	Biology and Environment: Proceedings of the Royal Irish Academy, 115B: 1-12
Year :	2015
Title :	River engineering works and lamprey ammocoetes; impacts, recovery, mitigation
Author :	King, J.J.; Wightman, G.D.; Hanna, G.; Gilligan, N.
Series :	Water and Environment Journal, 29: 482-488
Year :	2016
Title :	A narrative for conserving freshwater and wetland habitats in England
Author :	Mainstone, C.; Hall, R.; Diack, I.
Series :	Natural England Research Reports Number 064
Year :	2016
Title :	The Status of Irish Salmon Stocks in 2015 with Precautionary Catch Advice for 2016
Author :	SSCS (Standing Scientific Committee on Salmon)
Series :	Independent Scientific Report to Inland Fisheries Ireland
Year :	Undated
Title :	WFD111 (2a) Coarse resolution rapid-assessment methodology to assess obstacles to fish migration: Field manual level A assessment
Author :	SNIFFER (Scotland and Northern Ireland Forum for Environmental Research)
Series :	SNIFFER WFD111

Spatial data sources

Year :	Revision 2010
Title :	Saltmarsh Monitoring Project 2007-2008. Version 1
GIS Operations :	QIs selected; clipped to SAC boundary. Expert opinion used as necessary to resolve any issues arising
Used For :	1330, 1410 (map 3)
Year :	Revision 2010
Title :	National Survey of Native Woodlands 2003-2008. Version 1
GIS Operations :	QIs selected; clipped to SAC boundary. Expert opinion used as necessary to resolve any issues arising
Used For :	91A0, 91E0 (maps 4 and 5)
Year :	Revision 2012
Title :	Margaritifera Sensitive Areas data
GIS Operations :	Relevant catchment boundaries identified. Expert opinion used as necessary to resolve any issues arising
Used For :	1029 (map 6)
Year :	2016
Title :	NPWS rare and threatened species database
GIS Operations :	Dataset created from spatial references in database records. Expert opinion used as necessary to resolve any issues arising
Used For :	1029, 1092 (maps 6 and 7)
Year :	2010
Title :	EPA WFD Waterbodies data
GIS Operations :	Creation of 20m buffer to river and stream centreline data. Dataset combined with derived OSi data for 1355 SSCO. Overlapping regions investigated and resolved; resulting dataset clipped to SAC boundary. Expert opinion used as necessary to resolve any issues arising
Used For :	1355 (no map)
Year :	2005
Title :	OSi Discovery series vector data
GIS Operations :	Creation of 80m buffer on the marine side of high water mark (HWM); creation of 10m buffer on terrestrial side of HWM; combination of 80m and 10m HWM buffer datasets. Datasets combined with derived EPA WFD Waterbodies data for 1355 SSCO. Overlapping regions investigated and resolved; resulting dataset clipped to SAC boundary. Expert opinion used as necessary to resolve any issues arising
Used For :	1355 (no map)

1330 Atlantic salt meadows (Glauco-Puccinellietalia maritimae)

To restore the favourable conservation condition of Atlantic salt meadows (Glauco-Puccinellietalia maritimae) in Lower River Suir 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 the sub-site (Little Island) and potential areas mapped: 33.43ha. See map 3	Based on data from the Saltmarsh Monitoring Project (SMP) (McCorry and Ryle, 2009). The sub-site Little Island (SMP site ID: SMP0052) that supports Atlantic Salt Meadows (ASM) was mapped during the SMP (4.11ha) and additional areas of potential ASM habitat (29.32ha) were identified from an examination of aerial photographs, giving a total estimated area of 33.43ha within Lower River Suir SAC. NB further unsurveyed areas may be present within the SAC. See the Lower River Suir SAC conservation objectives supporting document for coastal habitats for further details
Habitat distribution	Occurrence	No decline or change in habitat distribution, subject to natural processes. See map 3 for known and potential distribution	Based on data from McCorry and Ryle (2009). Saltmarsh occurs on the River Suir estuary downstream of Waterford City in old flood meadows where the embankment is absent, or has been breached, and along the tidal stretches of some of the in-flowing channels below Little Island. NB further unsurveyed areas may be present within the SAC. See the coastal habitats supporting document for further details
Physical structure: sediment supply	Presence/absence of physical barriers	Maintain natural circulation of sediments and organic matter, without any physical obstructions	Based on data from McCorry and Ryle (2009). See the coastal habitats supporting document for further details
Physical structure: creeks and pans	Occurrence	Maintain creek and pan structure, subject to natural processes, including erosion and succession	Based on data from McCorry and Ryle (2009). Little Island saltmarsh contains a well-developed topography and large, deep creeks are present. See the coastal habitats supporting document for further details
Physical structure: flooding regime	Hectares flooded; frequency	Maintain natural tidal regime	Based on data from McCorry and Ryle (2009). Much of the shoreline along the Lower River Suir channel has been modified by embankments, infilling and drainage. See the coastal habitats supporting document for further details
Vegetation structure: zonation	Occurrence	Maintain the range of coastal habitats including transitional zones, subject to natural processes including erosion and succession	Based on data from McCorry and Ryle (2009). There are several saltmarsh communities present and zonation is moderately well-developed in the sub-site surveyed. The ASM transitions to grassland and freshwater habitats. This is typical of an estuary type saltmarsh with a significant freshwater influence. See the coastal habitats supporting document for further details
Vegetation structure: sward height	Centimetres	Maintain structural variation within sward	Based on data from McCorry and Ryle (2009). As the sub-site is not grazed, the sward height is lush and rank in places. However, the overall sward structure is still quite variable. See the coastal habitats supporting document for further details
Vegetation structure: vegetation cover	Percentage cover at a representative number of monitoring stops	Maintain more than 90% of the area outside of creeks vegetated	Based on data from McCorry and Ryle (2009). See the coastal habitats supporting document for further details
Vegetation composition: typical species and sub-communities	Percentage cover at a representative number of monitoring stops	Maintain range of sub-communities with typical species listed in McCorry and Ryle (2009)	See the coastal habitats supporting document for further details

Vegetation composition: negative indicator species - *Spartina anglica*	Hectares	No significant expansion of common cordgrass (*Spartina anglica*), with an annual spread of less than 1% where it is known to occur	Based on data from McCorry and Ryle (2009). Common cordgrass (*Spartina anglica*) is present in the SAC, but swards are not a significant feature. See the coastal habitats supporting document for further details

1410 Mediterranean salt meadows (Juncetalia maritimi)

To restore the favourable conservation condition of Mediterranean salt meadows (Juncetalia maritimi) in Lower River Suir 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	Mediterranean Salt Meadows (MSM) habitat was not recorded in Lower River Suir SAC during the Saltmarsh Monitoring Project (SMP) (McCorry and Ryle, 2009). Thus the total area of the qualifying habitat in the SAC is unknown. An NPWS survey in the 1990s noted stands of sea rush (*Juncus maritimus*), indicative of MSM, on the saltmarsh at Grantstown (NPWS internal files), but the habitat was not recorded in the Little Island sub-site during the SMP in 2007 (McCorry and Ryle, 2009). NB unsurveyed areas may be present within the SAC. See the Lower River Suir SAC conservation objectives supporting document for coastal habitats for further details
Habitat distribution	Occurrence	No decline or change in habitat distribution, subject to natural processes	See note on area above. NB unsurveyed areas may be present within the SAC. See the coastal habitats supporting document for further details
Physical structure: sediment supply	Presence/absence of physical barriers	Maintain natural circulation of sediments and organic matter, without any physical obstructions	Attribute and target based on data from McCorry and Ryle (2009). See the coastal habitats supporting document for further details
Physical structure: creeks and pans	Occurrence	Maintain creek and pan structure, subject to natural processes, including erosion and succession	Attribute and target based on data from McCorry and Ryle (2009). See the coastal habitats supporting document for further details
Physical structure: flooding regime	Hectares flooded; frequency	Maintain natural tidal regime	Attribute and target based on data from McCorry and Ryle (2009). Mediterranean salt meadow habitat is found high up in the saltmarsh but requires occasional tidal inundation. See the coastal habitats supporting document for further details
Vegetation structure: zonation	Occurrence	Maintain the range of coastal habitats including transitional zones, subject to natural processes including erosion and succession	Attribute and target based on data from McCorry and Ryle (2009). See the coastal habitats supporting document for further details
Vegetation structure: sward height	Centimetres	Maintain structural variation in the sward	Attribute and target based on data from McCorry and Ryle (2009). See the coastal habitats supporting document for further details
Vegetation structure: vegetation cover	Percentage cover at a representative number of monitoring stops	Maintain more than 90% of the area outside of creeks vegetated	Attribute and target based on data from McCorry and Ryle (2009). See the coastal habitats supporting document for further details
Vegetation composition: typical species and sub-communities	Percentage cover at a representative number of monitoring stops	Maintain range of sub-communities with characteristic species listed in McCorry and Ryle (2009)	See the coastal habitats supporting document for further details
Vegetation composition: negative indicator species - *Spartina anglica*	Hectares	No significant expansion of common cordgrass (*Spartina anglica*), with an annual spread of less than 1% where it is already known to occur	Attribute and target based on data from McCorry and Ryle (2009). See the coastal habitats supporting document for further details

3260 Water courses of plain to montane levels with the Ranunculion fluitantis and Callitricho-Batrachion vegetation

To maintain the favourable conservation condition of Water courses of plain to montane levels with the Ranunculion fluitantis and Callitricho-Batrachion vegetation in Lower River Suir 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	The description of habitat 3260 covers upland rivers with bryophytes and macroalgae to lowland depositing rivers with pondweeds and starworts. The selection of Lower River Suir SAC used this broad interpretation. Conservation objectives for habitat 3260 concentrate on the high conservation value sub-types, however, little is known of the habitat's distribution or its sub-types in Lower River Suir SAC. There is a large number of lowland and tidal rivers in the SAC, as well as faster-flowing tributaries. Note: rooted macrophytes should be absent or trace (<5% cover) in freshwater pearl mussel (*Margaritifera margaritifera*) habitat. The freshwater pearl mussel (1029) conservation objective takes precedence over this objective for habitat 3260 in the Clodiagh River (Portlaw) within this SAC, because the mussel requires environmental conditions close to natural background levels
Habitat distribution	Occurrence	No decline, subject to natural processes	Further study is needed of Irish sub-types and their conservation value to interpret the broad description of habitat 3260 (European Commission, 2013). As noted above, little is known about the distribution of the habitat and its sub-types in Lower River Suir SAC. The uncommon, protected opposite-leaved pondweed (*Groenlandia densa*) was recorded in the SAC from floodplain ditches of the Suir near Carrick-on-Suir and Clonmel, as well as the Clodiagh near Portlaw (Colgan and Scully, 1898; NPWS internal files). See NPWS (2012) for information on the requirements of opposite-leaved pondweed. There are no known records for rare or threatened bryophytes from the rivers in the SAC (Lockhart et al., 2012). The rivers in the SAC are mainly lowland, depositing and tidal, and are likely dominated by marginal and submerged higher plants. Some fast-flowing rivers also occur that should, naturally, be dominated by macroalgae and bryophytes, with limited submerged or emergent higher plants
Hydrological regime: river flow	Metres per second	Maintain appropriate hydrological regimes	High conservation value sub-types are associated with natural hydrology. A natural flow regime is required for both plant communities and channel geomorphology to be in favourable condition, exhibiting typical dynamics for the river type (Hatton-Ellis and Grieve, 2003). For many sub-types, high flows are required to maintain the substratum necessary for the characteristic species. Flow variation can be particularly important, with high and flood flows being critical to the hydromorphology. Other aspects of hydrology, such as tidal regime, are important for certain sub-types of the habitat. The rivers in the SAC vary from naturally flashy, through depositing to tidal reaches
Hydrological regime: groundwater discharge	Metres per second	Maintain appropriate hydrological regime	Even small groundwater contributions can significantly alter hydrochemistry, particularly where there is basic bedrock and/or subsoils. Freshwater seepages can be very important in tidal reaches

Hydrological regime: tidal influence	Daily water level fluctuations - metres	Maintain natural tidal regime	Opposite-leaved pondweed (*Groenlandia densa*) is typical of the tidal reaches of large Irish rivers, e.g. Suir, Slaney, Shannon and Blackwater (see Preston and Croft, 2001; Preston, 2003). This species is listed as Near Threatened (Wyse Jackson et al., 2016) and is protected on the Flora (Protection) Order, 2015 (Statutory Instrument No. 356 of 2015). Both the disturbance and substratum associated with the tidal regime may be important drivers
Substratum composition: particle size range	Millimetres	Maintain appropriate substratum particle size range, quantity and quality, subject to natural processes	Many of the high conservation value sub-types are dominated by coarse substrata, and it is likely that bedrock, boulders, cobbles and coarse gravels were naturally abundant in many tributaries in this SAC, particularly where the freshwater pearl mussel (*Margaritifera margaritifera*) occurred. Fine substrata are naturally abundant in depositing and tidal reaches. The size and distribution of particles are largely determined by the river flow. The chemical composition (particularly minerals and nutrients) of the substratum is also important. The quality of finer sediment particles is a notable driver of rooted plant communities. Note: increased fine sediment is contributing to the unfavourable status of the freshwater pearl mussel in the Clodiagh. See the freshwater pearl mussel (1029) conservation objective
Water quality	Various	Maintain appropriate water quality to support the natural structure and functioning of the habitat	The specific targets may vary among sub-types. Depositing and tidal stretches of rivers may, naturally, be more nutrient-rich and, therefore Water Framework Directive (WFD) good status may suffice in terms of nutrient and oxygenation standards, and EQRs (Ecological Quality Ratios) for macroinvertebrates and phytobenthos. Faster-flowing tributaries that are naturally dominated by bryophytes and macroalgae typically require WFD high status. High status targets apply to freshwater pearl mussel (*Margaritifera margaritifera*) habitat in the Clodiagh (see The European Communities Environmental Objectives (Freshwater Pearl Mussel) Regulations 2009 - S.I. No. 296 of 2009). See also The European Communities Environmental Objectives (Surface Waters) Regulations 2009 (S.I. No. 272 of 2009), Environmental Protection Agency (EPA) river water quality reports (e.g. Bradley et al., 2015) and Ní Chatháin et al. (2013)
Typical species	Occurrence	Maintain typical species in good condition, including appropriate distribution and abundance	The sub-types of this habitat are poorly understood and their typical species have not yet been fully defined. The typical species may include higher plants, bryophytes, macroalgae and microalgae, and invertebrates. As noted above, the protected vascular plant species opposite-leaved pondweed (*Groenlandia densa*) is associated with rivers and floodplains in the SAC. The banks of the Suir, particularly its tidal stretches, support a notable population of the rare *Rumex crispus* subsp. *uliginosus* (Green, 2008)
Floodplain connectivity	Hectares	Maintain floodplain connectivity necessary to support the typical species and vegetation composition of the habitat	River connectivity with the floodplain is important for the functioning of this habitat. Channels with a naturally functioning floodplain are better able to maintain habitat and water quality (Hatton-Ellis and Grieve, 2003). Floodplain connectivity is particularly important in terms of sediment sorting and nutrient deposition. High conservation value rivers are intimately connected to floodplain habitats and function as important wildlife corridors, connecting otherwise isolated or fragmented habitats in the wider countryside (Hatton-Ellis and Grieve, 2003; Mainstone et al., 2016). Alluvial woodland (91E0) is an important feature of rivers in Lower River Suir SAC (see the conservation objective for 91E0)

Fringing habitats	Hectares	Maintain marginal fringing habitats that support the typical species and vegetation composition of the habitat	Riparian habitats (including those along lake shores), particularly natural/semi-natural woodlands and wetlands, are an integral part of the structure and functioning of river systems, even where they do not form part of a natural floodplain. Fringing habitats can contribute to the aquatic food web (e.g. allochthonous matter such as leaf fall), provide habitat (refuge and resources) for certain life-stages of fish, birds and aquatic invertebrates, assist in the settlement of fine suspended material, protect banks from erosion and contribute to nutrient cycling. Shade may also be important in suppressing algal growth in enriched rivers and moderating temperatures. Equally, fringing habitats are dependent on rivers/lakes, particularly their water levels, and support wetland communities and species of conservation concern. See Mainstone et al. (2016). Alluvial and riparian woodland is important for the rivers in Lower River Suir SAC

6430 Hydrophilous tall herb fringe communities of plains and of the montane to alpine levels

To maintain the favourable conservation condition of Hydrophilous tall herb fringe communities of plains and of the montane to alpine levels in Lower River Suir 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	Hydrophilous tall herb fringe communities of plains and of the montane to alpine levels habitat has not been mapped in detail for Lower River Suir SAC and thus the total area of the qualifying habitat in the SAC is unknown. The lowland type communities of the habitat are considered to occur in association with the various areas of alluvial forest (91E0) within the SAC, notably at Fiddown, below Carrick-on-Suir and at Tibberaghny Marshes. This habitat type would also be expected to occur in association with other woodland types in fringe areas along the river and with areas of open marsh or wet grassland within the SAC (NPWS internal files)
Habitat distribution	Occurrence	No decline, subject to natural processes	See notes on area above
Hydrological regime: Flooding depth/height of water table	Metres	Maintain appropriate hydrological regime	This habitat requires winter inundation, which results in deposition of naturally nutrient-rich sediment
Vegetation composition: positive indicator species	Number of species at a representative number of monitoring stops	At least three positive indicator species present	Attribute and target based on O'Neill et al. (2013), where the list of positive indicator species is also presented
Vegetation composition: positive indicator species	Percentage cover at a representative number of monitoring stops	Cover of positive indicator species at least 40%	Attribute and target based on O'Neill et al. (2013), where the list of positive indicator species is also presented
Vegetation composition: non-native species	Percentage cover at a representative number of monitoring stops	Cover of non-native species not more than 1%	Attribute and target based on O'Neill et al. (2013). The spread of Japanese knotweed (*Fallopia japonica*) is noted as a threat at Tibberaghny (NPWS internal files)
Vegetation composition: negative indicator species	Percentage at a representative number of monitoring stops	Cover of negative indicator species not more than 33%	Attribute and target based on O'Neill et al. (2013), where the list of negative indicator species is also presented
Vegetation composition: scrub, bracken and heath	Percentage at a representative number of monitoring stops	Cover of scrub, bracken (*Pteridium aquilinum*) and heath not more than 5%	Attribute and target based on O'Neill et al. (2013)
Vegetation structure: height	Height (centimetres) at a representative number of monitoring stops	Herb height at least 50cm	Attribute and target based on O'Neill et al. (2013)
Physical structure: bare soil	Percentage at a representative number of monitoring stops	Cover of bare soil not more than 10%	Attribute and target based on O'Neill et al. (2013)
Physical structure: grazing and disturbance	Square metres in local vicinity of a representative number of monitoring stops	Area of the habitat showing signs of serious grazing or disturbance less than 20m²	Attribute and target based on O'Neill et al. (2013)

91A0 Old sessile oak woods with Ilex and Blechnum in the British Isles

To restore the favourable conservation condition of Old sessile oak woods with *Ilex* and *Blechnum* in the British Isles in Lower River Suir 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, at least 29.3ha for sites surveyed. See map 4	Old sessile oak woods with *Ilex* and *Blechnum* were surveyed in Lower River Suir SAC by Perrin et al. (2008) as part of the National Survey of Native Woodlands (NSNW) at Lyranearla (NSNW site code: 1834) and Inchinsqullib Wood (NSNW site code: 1898). The area of old oak woodlands in the surveyed sites within the SAC is estimated to be 29.3ha. It is important to note that further unsurveyed areas are present within the SAC, including at Portlaw Wood within the Curraghmore Estate and other small pockets within the SAC (NPWS internal files). Map 4 shows the old oak woodlands surveyed by Perrin et al. (2008)
Habitat distribution	Occurrence	No decline. Surveyed locations shown on map 4	Distribution shown based on Perrin et al. (2008). NB further unsurveyed areas are present within this SAC
Woodland size	Hectares	Area stable or increasing. Where topographically possible, "large" woods at least 25ha in size and "small" woods at least 3ha in size	The target areas for individual woodlands aim to reduce habitat fragmentation and benefit those species requiring 'deep' woodland conditions (Peterken, 2002). In some cases, topographical constraints may restrict expansion
Woodland structure: cover and height	Percentage and metres	Diverse structure with a relatively closed canopy containing mature trees; subcanopy layer with semi-mature trees and shrubs; and well-developed herb layer	Described in Perrin et al. (2008) and NPWS internal files
Woodland structure: community diversity and extent	Hectares	Maintain diversity and extent of community types	Described in Perrin et al. (2008) and NPWS internal files
Woodland structure: natural regeneration	Seedling: sapling: pole ratio	Seedlings, saplings and pole age-classes occur in adequate proportions to ensure survival of woodland canopy	Oak (*Quercus petraea*) generally regenerates poorly. In suitable sites, ash (*Fraxinus excelsior*) can regenerate in large numbers although few seedlings reach pole size
Woodland structure: dead wood	m^3 per hectare; number per hectare	At least 30m^3/ha of fallen timber greater than 10cm diameter; 30 snags/ha; both categories should include stems greater than 40cm diameter	Dead wood is a valuable resource and an integral part of a healthy, functioning woodland ecosystem
Woodland structure: veteran trees	Number per hectare	No decline	Mature and veteran trees are important habitats for bryophytes, lichens, saproxylic organisms and some bird species. Their retention is important to ensure continuity of habitats/niches and propagule sources
Woodland structure: indicators of local distinctiveness	Occurrence	No decline	Includes ancient or long-established woodlands (see Perrin and Daly, 2010), archaeological and geological features as well as red-listed and other rare or localised species. The rare lichen tree lungwort (*Lobaria pulmonaria*), an indicator of ancient woodlands, is found in Portlaw Wood (NPWS internal files)
Vegetation composition: native tree cover	Percentage	No decline. Native tree cover not less than 95%	Species reported in Perrin et al. (2008) and NPWS internal files

Vegetation composition: typical species	Occurrence	A variety of typical native species present, depending on woodland type, including oak (*Quercus petraea*) and birch (*Betula pubescens*)	Species reported in Perrin et al. (2008) and NPWS internal files
Vegetation composition: negative indicator species	Occurrence	Negative indicator species, particularly non-native invasive species, absent or under control	Rhododendron (*Rhododendron ponticum*) infestation at Portlaw Wood is noted as being serious, as well as the occurrence of beech (*Fagus sylvatica*), sycamore (*Acer pseudoplatanus*) and silver fir (*Abies alba*) in the woodland (NPWS internal files). Beech was reported from Lyranearla (NSNW site code: 1834) by Perrin et al. (2008)

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

To restore the favourable conservation condition of Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (Alno-Padion, Alnion incanae, Salicion albae)* in Lower River Suir 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, at least 32.9ha for sites surveyed. See map 5	Alluvial forest was surveyed in Lower River Suir SAC by Perrin et al. (2008) as part of the National Survey of Native Woodlands (NSNW) at Fiddown (NSNW site code: 0022), Mountbolton (NSNW site code: 1823) and Ballycanvan Big (NSNW site code: 1839). Fiddown (0022) was also included in a national monitoring survey (O'Neill and Barron, 2013). The area of alluvial woodlands in the surveyed sites within the SAC is estimated to be 32.9ha. It is important to note that further unsurveyed areas of alluvial forest are present within the SAC, for example at islands below Carrick-on-Suir, at Shanbally (Coillte LIFE project site), Tibberaghny Marshes, along the lower stretches of the more westerly of the Suir tributaries and along both banks of the Suir as far east as the Dawn River (NPWS internal files). Map 5 shows the alluvial woodlands surveyed by Perrin et al. (2008)
Habitat distribution	Occurrence	No decline. Surveyed locations shown on map 5	Distribution shown based on Perrin et al. (2008). NB further unsurveyed areas are present within the SAC
Woodland size	Hectares	Area stable or increasing. Where topographically possible, "large" woods at least 25ha in size and "small" woods at least 3ha in size	The target areas for individual woodlands aim to reduce habitat fragmentation and benefit those species requiring 'deep' woodland conditions (Peterken, 2002). In some cases, topographical constraints may restrict expansion
Woodland structure: cover and height	Percentage and metres	Diverse structure with a relatively closed canopy containing mature trees; subcanopy layer with semi-mature trees and shrubs; and well-developed herb layer	Described in Perrin et al. (2008) and NPWS internal files
Woodland structure: community diversity and extent	Hectares	Maintain diversity and extent of community types	Described in Perrin et al. (2008) and NPWS internal files
Woodland structure: natural regeneration	Seedling:sapling:pole ratio	Seedlings, saplings and pole age-classes occur in adequate proportions to ensure survival of woodland canopy	Alder (*Alnus glutinosa*) and oak (*Quercus* spp.) tend to regenerate poorly. Ash (*Fraxinus excelsior*) often regenerates in large numbers although few seedlings reach pole size
Hydrological regime: flooding depth/height of water table	Metres	Appropriate hydrological regime necessary for maintenance of alluvial vegetation	Periodic flooding is essential to maintain alluvial woodlands along river floodplains, but not for woodland around springs/seepage areas
Woodland structure: dead wood	m^3 per hectare; number per hectare	At least $30m^3$/ha of fallen timber greater than 10cm diameter; 30 snags/ha; both categories should include stems greater than 40cm diameter (greater than 20cm diameter in the case of alder (*Alnus glutinosa*))	Dead wood is a valuable resource and an integral part of a healthy, functioning woodland ecosystem
Woodland structure: veteran trees	Number per hectare	No decline	Mature and veteran trees are important habitats for bryophytes, lichens, saproxylic organisms and some bird species. Their retention is important to ensure continuity of habitats/niches and propagule sources

Woodland structure: indicators of local distinctiveness	Occurrence	No decline	Includes ancient or long-established woodlands, archaeological and geological features as well as red-listed and other rare or localised species. Perrin and Daly (2010) identify the site Ballycanvan Big (NSNW site code: 1839) as being "possible ancient woodland"
Vegetation composition: native tree cover	Percentage	No decline. Native tree cover not less than 95%	Species reported in Perrin et al. (2008) and NPWS internal files
Vegetation composition: typical species	Occurrence	A variety of typical native species present, depending on woodland type, including alder (*Alnus glutinosa*), willows (*Salix* spp.), oak (*Quercus* spp.), ash (*Fraxinus excelsior*) and birch (*Betula pubescens*)	Species reported in Perrin et al. (2008) and NPWS internal files
Vegetation composition: negative indicator species	Occurrence	Negative indicator species, particularly non-native invasive species, absent or under control	Norway spruce (*Picea abies*) and sycamore (*Acer pseudoplatanus*) occur at Shanbally (NPWS internal files). Spread of Japanese knotweed (*Fallopia japonica*) is a problem at Tibberaghny (NPWS internal files). Cherry laurel (*Prunus laurocerasus*) and rhododendron (*Rhododendron ponticum*) have been reported as occurring in part of Ballycanvan Big (NSNW site code: 1839) by Perrin et al. (2008), but not within the alluvial woodland

91J0 Taxus baccata woods of the British Isles

To restore the favourable conservation condition of *Taxus baccata* woods of the British Isles* in Lower River Suir 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	*Taxus baccata* woods of the British Isles habitat has not been mapped in detail for Lower River Suir SAC and thus the total area of the qualifying habitat is unknown. Yew (*Taxus baccata*) woodland is known to occur at Cahir Park in an area of c.500m by 50m. Cahir Park was included in a national monitoring survey of yew woodland (Cross and Lynn, 2013). NB further unsurveyed areas may be present within the SAC
Habitat distribution	Occurrence	No decline	A narrow stand of yew woodland occurs along the steep western flank of a limestone knoll at Cahir Park within Lower River Suir SAC. See Cross and Lynn (2013) for further details. NB further unsurveyed areas may be present within the SAC
Woodland size	Hectares	Area stable or increasing	Yew (*Taxus baccata*) has been planted on deeper soil on top of the knoll at Cahir Park. If the transplants survive, the area of yew woodland will be considerably expanded. See Cross and Lynn (2013) for further details
Woodland structure: cover and height	Percentage and metres	Diverse structure with a relatively closed canopy containing mature trees; subcanopy layer with semi-mature trees and shrubs; and herb and bryophyte layer	See Perrin et al. (2008) and Cross and Lynn (2013) for further details
Woodland structure: community diversity and extent	Hectares	Maintain diversity and extent of community types	See Perrin et al. (2008) and Cross and Lynn (2013) for further details
Woodland structure: natural regeneration	Seedling:sapling:pole ratio	Seedlings, saplings and pole age-classes occur in adequate proportions to ensure survival of woodland canopy	Yew (*Taxus baccata*) regenerates poorly under its own canopy but can regenerate under a canopy of other species or in the open if the competition from the field layer is not too strong
Woodland structure: dead wood	m^3 per hectare; number per hectare	At least $30m^3$/ha of fallen timber greater than 10cm diameter; 30 snags/ha; both categories should include stems greater than 40cm diameter	Dead wood is a valuable resource and an integral part of a healthy, functioning woodland ecosystem
Woodland structure: veteran trees	Number per hectare	No decline	Mature and veteran trees are important habitats for bryophytes, lichens, saproxylic organisms and some bird species. Their retention is important to ensure continuity of habitats/niches and propagule sources
Woodland structure: indicators of local disctinctiveness	Occurrence	No decline	Includes ancient or long-established woodlands (see Perrin and Daly, 2010), archaeological and geological features as well as red-data and other rare or localised species
Vegetation composition: native tree cover	Percentage	No decline. Native tree cover not less than 95%	See Perrin et al. (2008) and Cross and Lynn (2013) for further details
Vegetation composition: typical species	Occurrence	A variety of typical native species present, including yew (*Taxus baccata*) and ash (*Fraxinus excelsior*)	See Perrin et al. (2008) and Cross and Lynn (2013) for further details

Vegetation composition: negative indicator species	Occurrence	Negative indicator species, particularly non-native invasive species, absent or under control	The most common invasive species in this woodland type is beech (*Fagus sylvatica*), although there is evidence to suggest that it actually facilitates regeneration of yew (*Taxus baccata*). Numerous exotic species, including cherry laurel (*Prunus laurocerasus*) in particular, have been reported from Cahir Park (Cross and Lynn, 2013)

1029 Freshwater Pearl Mussel *Margaritifera margaritifera*

To restore the favourable conservation condition of Freshwater Pearl Mussel in Lower River Suir SAC, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Distribution	Kilometres	Restore distribution to 10.4km. See map 6	The conservation objective applies to the Clodiagh freshwater pearl mussel (*Margaritifera margaritifera*) population, which is listed on The European Communities Environmental Objectives (Freshwater Pearl Mussel) Regulations 2009. (S.I. 296 of 2009). Full baseline distribution and abundance mapping was conducted in 2006 (Ross, 2006). Mussel habitat is widespread in the Clodiagh, with mussels almost continually present in low numbers from downstream of Clonea to above Portlaw (Ross, 2006). Mussels were nowhere abundant; maximum density was 3 per square metre (Ross, 2006). The habitat is significantly below carrying-capacity. The distribution in the Clodiagh has contracted since the 1990s (Ross, 2006). The target is for the species to be sufficiently widespread to maintain itself on a long-term basis as a viable component of the Clodiagh system. See NPWS (2010) for further information
Population size	Number of adult mussels	Restore population to at least 10,000 adult mussels	Ross (2006) counted 1,206 mussels and estimated a total population of 2,412, concluding that, given the large areas of physically suitable habitat, a much larger population was previously present and a major population decline had occurred. Ross (2009) measured an 18.5% decline in mussel numbers between 2006 and 2009 at transect 1, indicating continued losses. Ross et al. (2017) recorded 'rapid and alarming' declines of 56-94% between 2006 and 2016 at five monitoring locations (67% decline overall). Moorkens (2010) estimated the population to be less than 10,000. The target of 10,000 is considered appropriate for a functional, self-sustaining population. NPWS (2013), in producing a national population estimate, assumed the Clodiagh population had declined at a rate of 3% per year. The target is for the species to be sufficiently abundant to maintain itself on a long-term basis as a viable component of the Clodiagh system
Population structure: recruitment	Percentage per size class	Restore to at least 20% of each population no more than 65mm in length; and at least 5% of each population no more than 30mm in length	Mussels ≤65mm are 'young mussels' and found buried in the substratum or beneath adult mussels. Mussels ≤30mm are 'juvenile mussels' and always buried in the substratum. See the European Communities Environmental Objectives (Freshwater Pearl Mussel) Regulations 2009. The Clodiagh failed both targets in 2006, 2009 and 2016 (Ross, 2006, 2009; NPWS, 2010; Ross et al., 2017). Ross (2006) found no juveniles, ≤65mm extremely uncommon, smallest individual was 45.4mm and 97% was >80mm. In 2009, the smallest mussel was 78mm and (based on Ross, 1988) 15-20 years old (Ross, 2009). The smallest of 21 mussels measured in 1986 was 48.6mm (Ross, 1988). NPWS (2010) concluded there had been no successful recruitment from 1986 to 2009. The Clodiagh population is considered to be unsustainable owing to lack of survival of juvenile and adult mussels. The target is for sufficient juvenile recruitment to allow the species to maintain itself on a long-term basis as a viable component of the Clodiagh system

Population structure: adult mortality	Percentage	No more than 5% decline from previous number of live adults counted; dead shells less than 1% of the adult population and scattered in distribution	5% is considered the cut-off between the combined errors associated with natural fluctuations and sampling methods and evidence of true population decline. 1% of dead shells is considered to be indicative of natural losses. The Clodiagh failed both targets in 2009 (Ross, 2009; NPWS, 2010) and, as noted above, a major population decline has occurred (Ross, 2006; Ross et al., 2017), and is presumed to be on-going. In 2009, 1 transect and 1 delimited count were counted: T1 numbers had fallen from 27 in 2006 to 22, representing a 18.5% decline, while numbers were the same in C2. Seven dead shells were found among 23 live mussels at one location, indicating high mortality in parts of the Clodiagh. In 2016, 67 mussels were counted at five monitoring sites that had 205 mussels in 2006 (Ross et al., 2017). The target is for sufficient survival of adults to allow the species to maintain itself on a long-term basis as a viable component of the Clodiagh system
Suitable habitat: extent	Kilometres	Restore suitable habitat in more than 8.8km in the Clodiagh system and any additional stretches necessary for salmonid spawning	Mussel habitat in the Clodiagh is known to occur from Clonea to Portlaw, and is sparsely occupied from c.630m downstream of Clonea to c.1.8km above Portlaw (Ross, 2006). Mussels were recorded at Portlaw as recently as the 1990s and downstream of Portlaw in the early 20th century. It is possible that some mussel habitat occurs upstream or downstream of the mapped stretches, but few mussels are likely to be found (Ross, 2006). The mussel habitat has been severely impacted for a significant period by sedimentation, other hydromorphological changes, organic pollution and eutrophication (NPWS, 2010). The target is for sufficient habitat in favourable condition to allow the species to maintain itself on a long-term basis as a viable component of the Clodiagh system
Suitable habitat: condition	Kilometres	Restore condition of suitable habitat	The species' habitat is a combination of the area of 1) habitat adult and juvenile mussels can occupy; 2) spawning and nursery habitats host fish can occupy. Fish nursery and mussel habitat typically overlap. Fish spawning habitat is generally adjacent to mussel habitat, but may lie upstream of the generalised mussel distribution. Only spawning areas that regularly contribute juvenile fish to adult mussel habitat should be considered. Availability of mussel and fish habitat is determined by flow and substratum conditions. It is highly sensitive to hydromorphological changes, sedimentation and enrichment. Pressures throughout the catchment contribute to such impacts. Mussel habitat is widespread in the Clodiagh but in unfavourable condition owing to sedimentation, other hydro-morphological changes and nutrient enrichment. The target is for sufficient habitat in favourable condition to allow the species to maintain itself on a long-term basis as a viable component of the Clodiagh system

Water quality: macroinvertebrate and phytobenthos (diatoms)	Ecological quality ratio (EQR)	Restore water quality - macroinvertebrates: EQR greater than 0.90 (Q4-5 or Q5); phytobenthos: EQR greater than 0.93	The EQRs correspond to high ecological status for these two Water Framework Directive biological quality elements. They represent high water quality with very low nutrient concentrations (oligotrophic conditions). In 2009, the habitat in the Clodiagh system failed the macroinvertebrate target, but passed the phytobenthos target (Morgan, 2009; Ní Chatháin, 2010; NPWS, 2010). Q values in the mussel habitat were Q3-Q4 (Morgan, 2009). There has been a gradual decline in quality at several main-channel sites since the late 1970s (Morgan, 2009). Sewage discharge at Clonea is impacting water quality downstream of Clonea Bridge (Ross, 2006; Morgan, 2009; Ní Chatháin, 2010; NPWS, 2010). See also The European Communities Environmental Objectives (Surface Waters) Regulations 2009. The target is for sufficient habitat in favourable condition to allow the species to maintain itself on a long-term basis as a viable component of the Clodiagh system
Substratum quality: filamentous algae (macroalgae); macrophytes (rooted higher plants)	Percentage	Restore substratum quality - filamentous algae: absent or trace (less than 5%); macrophytes: absent or trace (less than 5%)	The Clodiagh failed the macrophyte target, but marginally passed the macroalgal target in 2009 (NPWS, 2010). Patches of abundant *Ranunculus* were recorded by all surveyors, with up to 40% cover in places (Morgan, 2009; Ross, 2009; Ní Chatháin, 2010; NPWS, 2010). Ross (2006) also recorded widespread and, in places, abundant (up to 80%) *Ranunculus*. Algae were generally absent in 2009, however up to 10% *Cladophora* cover was recorded downstream of Clonea Bridge (Ní Chatháin, 2010; NPWS, 2010), where sewage fungus had previously been recorded (Ross, 2006). Algae were also sparse in 2006 and 2016 (Ross, 2006; Ross et al., 2017). Tree shade may be supressing plant growth over much of the mussel habitat (Ross et al., 2017). The target is for sufficient habitat in favourable condition to allow the species to maintain itself on a long-term basis as a viable component of the Clodiagh system
Substratum quality: sediment	Occurrence	Restore substratum quality - stable cobble and gravel substrate with very little fine material; no artificially elevated levels of fine sediment	The Clodiagh failed the target for the Sub-basin Management Plan in 2009 and 2016, with strong silt plumes recorded in mussel habitat (Ross, 2009; NPWS, 2010; Ross et al., 2017). Ross et al. (2017) recorded extremely heavy silt plumes at every site, even in fast riffles. Ross (2006) recorded significant siltation of the mussel habitat and observed river bank erosion and collapse, and livestock entry to the river. Silt in the Clodiagh is providing a rooting medium for macrophytes. Sufficient survival of juvenile and adult mussels is being prevented by the poor condition of the river substratum. The target is for sufficient habitat in favourable condition to allow the species to maintain itself on a long-term basis as a viable component of the Clodiagh system
Substratum quality: oxygen availability	Redox potential	Restore to no more than 20% decline from water column to 5cm depth in substrate	Differences in redox potential between the water column and the substrate correlate with differences in oxygen levels. Juvenile mussels require full oxygenation while buried in gravel. In suitable habitat, there should be very little loss of redox potential between the water column and underlying gravels. Average redox was very poor, 23-28% at four sites monitored in 2016, only three of the 40 measurements was <20% (Ross et al., 2017). The target is for sufficient habitat in favourable condition to allow the species to maintain itself on a long-term basis as a viable component of the Clodiagh system

Hydrological regime: flow variability	Metres per second	Maintain appropriate hydrological regime	The availability of suitable freshwater pearl mussel habitat is largely determined by flow (catchment geology being the other key factor). To restore the habitat for the species, flow variability over the annual cycle must be such that: 1) high flows can wash fine sediments from the substratum; 2) high flows are not artificially increased so as to cause excessive scour of mussel habitat; 3) low flows do not exacerbate the deposition of fine sediment or growth of algae/macrophytes and 4) low flows do not cause stress to mussels in terms of exposure, water temperatures, food availability or aspects of the reproductive cycle; see Moorkens and Killeen (2014). Groundwater inflow to the substratum contributes to water-cycling. The target is for sufficient habitat in favourable condition to allow the species to maintain itself on a long-term basis as a viable component of Clodiagh system
Host fish	Number	Maintain sufficient juvenile salmonids to host glochidial larvae	Salmonid fish are host to the larval stage of the freshwater pearl mussel and essential to completion of the life cycle. 0+ and 1+ fish are typically used, both because of habitat overlaps and the development of immunity with age in fish. Fish presence is sufficient, as higher fish density and biomass is indicative of enriched conditions in mussel rivers. Geist et al. (2006) found that higher densities of host fish coincided with eutrophication, poor substrate quality for mussels and a lack of mussel recruitment, while significantly lower host fish density and biomass were associated with high juvenile mussel numbers. Fish movements must be such that 0+ fish remain in the mussel habitat until their 1+ summer. No fish stocking should occur within the mussel habitat, nor any works that may change the salmonid balance or residency time. No glochidia were found on young Clodiagh fish in May 2009, although six trout and 38 salmon were caught (Johnston, 2009; NPWS, 2010)
Fringing habitat: area and condition	Hectares	Restore the area and condition of fringing habitats necessary to support the population	Riparian habitats, including those along lake fringes, particularly natural/semi-natural woodlands and wetlands, even where they do not form part of a natural floodplain, are an integral part of the structure and functioning of river systems. Fringing habitats aid in the settlement of fine suspended matter, protect banks from erosion, contribute to nutrient cycling and to the aquatic food web (e.g. allochthonous matter such as leaf fall) and provide habitat for life-stages of fish, birds and aquatic invertebrates. Shade may also be important in suppressing algal and macrophyte growth in enriched rivers (e.g. along parts of the Clodiagh) and moderating temperatures. Equally, fringing habitats are dependent on rivers/lakes, particularly their water levels, and support wetland communities and species of conservation concern. The target is for sufficient habitat in favourable condition to allow the species to maintain itself on a long-term basis as a viable component of the Clodiagh system

1092 White-clawed Crayfish *Austropotamobius pallipes*

To maintain the favourable conservation condition of White-clawed Crayfish in Lower River Suir SAC, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Distribution	Occurrence	No reduction from baseline. See map 7	White-clawed crayfish (*Austropotamobius pallipes*) occurs extensively on the River Suir and on many of its tributaries. On the River Suir main channel, the species has been recorded on almost the entire length of non-tidal river from the most upstream point at Cabragh, near Thurles, to downstream of Kilsheelan. It is also present on the following tributaries: Anner and Clashawley, Clodiagh and Owenbeg, Multeen, Tar, Nier, and Clodiagh Lower
Population structure: recruitment	Occurrence of juveniles and females with eggs	Juveniles and/or females with eggs in all occupied tributaries	See Reynolds et al. (2010) for further details
Negative indicator species	Occurrence	No alien crayfish species	Alien crayfish species are identified as a major direct threat to this species and as a disease vector. Ireland is currently free of non-native invasive crayfish species. See Reynolds (1998) for further details
Disease	Occurrence	No instances of disease	Disease is identified as a major threat and crayfish plague has occurred in Ireland even in the absence of alien vectors. Disease can, in some circumstances, be introduced through contaminated equipment and water in the absence of vector species. See Reynolds (1998) for further details
Water quality	EPA Q value	At least Q3-4 at all sites sampled by EPA	Target taken from Demers and Reynolds (2002). Q values based on triennial water quality surveys carried out by the Environmental Protection Agency (EPA)
Habitat quality: heterogeneity	Occurrence of positive habitat features	No reduction in habitat heterogeneity or habitat quality	Crayfish need high habitat heterogeneity. Larger crayfish must have stones to hide under, or an earthen bank in which to burrow. Hatchlings shelter in vegetation, gravel and among fine tree roots. Smaller crayfish are typically found among weed and debris in shallow water. Larger juveniles in particular may also be found among cobbles and detritus, such as leaf litter. These conditions must be available on the whole length of occupied habitat

1095 Sea Lamprey *Petromyzon marinus*

To restore the favourable conservation condition of Sea Lamprey in Lower River Suir SAC, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Distribution: extent of anadromy	Percentage of river accessible	Greater than 75% of main stem length of rivers accessible from estuary	Artificial barriers can block or cause difficulties to lampreys' upstream migration, thereby limiting the species to lower stretches and restricting access to spawning areas (Gargan et al., 2011; Rooney et al., 2015). Float-over surveys by Inland Fisheries Ireland (IFI) point to little success of sea lamprey adults in passing the weirs in Clonmel in Lower River Suir SAC. Modifications to these weirs would facilitate upstream passage of sea lamprey. IFI has embarked on a programme of detailed survey of major barriers in SAC catchments, in the context of sea lamprey passage, using the SNIFFER (Scotland and Northern Ireland Forum for Environmental Research) WFDIII methodology
Population structure of juveniles	Number of age/size groups	At least three age/size groups present	Attribute and target based on data from Harvey and Cowx (2003) and O'Connor (2007). A catchment-wide larval lamprey survey was completed by IFI in 2016. The data are currently being analysed
Juvenile density in fine sediment	Juveniles/m²	Juvenile density at least 1/m²	Juveniles burrow in areas of fine sediment in still water. Attribute and target based on data from Harvey and Cowx (2003). A catchment-wide larval lamprey survey was completed by IFI in 2016. The data are currently being analysed
Extent and distribution of spawning habitat	m² and occurrence	No decline in extent and distribution of spawning beds	Attribute and target based on spawning bed mapping by IFI. Lampreys spawn in clean gravels. Substantial areas of suitable spawning habitat are available from Cahir to Carrick-on-Suir, but access to areas upstream of Clonmel is problematic
Availability of juvenile habitat	Number of positive sites in 3rd order channels (and greater), downstream of spawning areas	More than 50% of sample sites positive	Silting habitat is essential for larval lamprey and they can be severely impacted by sediment removal. Recovery can be rapid and newly-created habitat can be rapidly colonised (King et al., 2015). However, it is vital that such sedimenting habitats are retained

1096 Brook Lamprey *Lampetra planeri*

To restore the favourable conservation condition of Brook Lamprey in Lower River Suir SAC, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Distribution	Percentage of river accessible	Access to all water courses down to first order streams	Artificial barriers can block or cause difficulties to lampreys' migration both up- and downstream, thereby possibly limiting species to specific stretches, restricting access to spawning areas and creating genetically isolated populations (Espanhol et al., 2007)
Population structure of juveniles	Number of age/size groups	At least three age/size groups of brook/river lamprey present	Attribute and target based on data from Harvey and Cowx (2003) and O'Connor (2007). It is impossible to distinguish between brook and river lamprey juveniles in the field (Gardiner, 2003), hence they are considered together in this target
Juvenile density in fine sediment	Juveniles/m²	Mean catchment juvenile density of brook/river lamprey at least 2/m²	Juveniles burrow in areas of fine sediment in still water. Attribute and target based on data from Harvey and Cowx (2003) who state 10/m² in optimal conditions and more than 2/m² on a catchment basis. A catchment-wide larval lamprey survey was completed by Inland Fisheries Ireland (IFI) in 2016. The data are currently being analysed
Extent and distribution of spawning habitat	m² and occurrence	No decline in extent and distribution of spawning beds	Attribute and target based on spawning bed mapping by IFI. Brook lampreys spawn in clean gravels where they excavate shallow nests and can spawn communally (Rooney et al., 2013)
Availability of juvenile habitat	Number of positive sites in 2nd order channels (and greater), downstream of spawning areas	More than 50% of sample sites positive	Silting habitat is essential for larval lamprey and they can be severely impacted by sediment removal. Recovery can be rapid and newly-created habitat can be rapidly colonised (King et al., 2015). However, it is vital that such sedimenting habitats are retained

1099 River Lamprey *Lampetra fluviatilis*

To restore the favourable conservation condition of River Lamprey in Lower River Suir SAC, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Distribution	Percentage of river accessible	Access to all water courses down to first order streams	Artificial barriers can block river lampreys' migration both up- and downstream, thereby limiting species to specific stretches, restricting access to spawning areas and creating genetically isolated populations (Espanhol et al., 2007)
Population structure of juveniles	Number of age/size groups	At least three age/size groups of river/brook lamprey present	Attribute and target based on data from Harvey and Cowx (2003) and O'Connor (2007). It is impossible to distinguish between river and brook lamprey juveniles in the field (Gardiner, 2003), hence they are considered together in this target
Juvenile density in fine sediment	Juveniles/m²	Mean catchment juvenile density of brook/river lamprey at least 2/m²	Juveniles burrow in areas of fine sediment in still water. Attribute and target based on data from Harvey and Cowx (2003) who state 10/m² in optimal conditions and more than 2/m² on a catchment basis. A catchment-wide larval lamprey survey was completed by Inland Fisheries Ireland (IFI) in 2016. The data are currently being analysed
Extent and distribution of spawning habitat	m² and occurrence	No decline in extent and distribution of spawning beds	Attribute and target based on spawning bed mapping by Inland Fisheries Ireland (IFI). River lampreys spawn in clean gravels where thay excavate shallow nests and can spawn communally in numbers (Rooney et al., 2013)
Availability of juvenile habitat	Number of positive sites in 2nd order channels (and greater), downstream of spawning areas	More than 50% of sample sites positive	Silting habitat is essential for larval lamprey and they can be severely impacted by sediment removal. Recovery can be rapid and newly-created habitat can be rapidly colonised (King et al., 2015). However, it is vital that such sedimenting habitats are retained

1103 Twaite Shad *Alosa fallax fallax*

To restore the favourable conservation condition of Twaite Shad in Lower River Suir SAC, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Distribution: extent of anadromy	Percentage of river accessible	Greater than 75% of main stem length of rivers accessible from estuary	In some catchments, artificial barriers block twaite shads' upstream migration, thereby limiting species to lower stretches and restricting access to spawning areas
Population structure: age classes	Number of age classes	More than one age class present	
Extent and distribution of spawning habitat	m² and occurrence	No decline in extent and distribution of spawning habitats	
Water quality: oxygen levels	Milligrams per litre	No lower than 5mg/l	Attribute and target based on Maas et al. (2008)
Spawning habitat quality: Filamentous algae; macrophytes; sediment	Occurrence	Maintain stable gravel substrate with very little fine material, free of filamentous algal (macroalgae) growth and macrophyte (rooted higher plants) growth	See Maitland and Hatton-Ellis (2003) for further information

1106 Salmon *Salmo salar*

To restore the favourable conservation condition of Atlantic Salmon in Lower River Suir SAC, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Distribution: extent of anadromy	Percentage of river accessible	100% of river channels down to second order accessible from estuary	Artificial barriers block salmons' upstream migration, thereby limiting species to lower stretches and restricting access to spawning areas
Adult spawning fish	Number	Conservation limit (CL) for each system consistently exceeded	A conservation limit (CL) is defined by the North Atlantic Salmon Conservation Organisation (NASCO) as "the spawning stock level that produces long-term average maximum sustainable yield as derived from the adult to adult stock and recruitment relationship". The target is based on the Standing Scientific Committee on Salmon (SSCS) annual model output of CL attainment levels. See SSCS (2016). Attainment of CL estimates are derived from direct counts of adults (rod catch, fish counter) or indirectly by fry abundance counts. The Suir is currently below CL, meeting 79% of CL
Salmon fry abundance	Number of fry/5 minutes electrofishing	Maintain or exceed 0+ fry mean catchment-wide abundance threshold value. Currently set at 17 salmon fry/5 minutes sampling	The target is the threshold value for rivers currently exceeding their conservation limit (CL). The average electrofishing value for the Suir in 2016 was 10.2 salmon fry, which is below the 17 fry target
Out-migrating smolt abundance	Number	No significant decline	Smolt abundance can be negatively affected by a number of impacts such as estuarine pollution, predation and sea lice (*Lepeophtheirus salmonis*)
Number and distribution of redds	Number and occurrence	No decline in number and distribution of spawning redds due to anthropogenic causes	Salmon spawn in clean gravels. Artificial barriers are generally not currently preventing salmon from accessing suitable spawning habitat in Lower River Suir SAC
Water quality	EPA Q value	At least Q4 at all sites sampled by EPA	Q values based on triennial water quality surveys carried out by the Environmental Protection Agency (EPA)

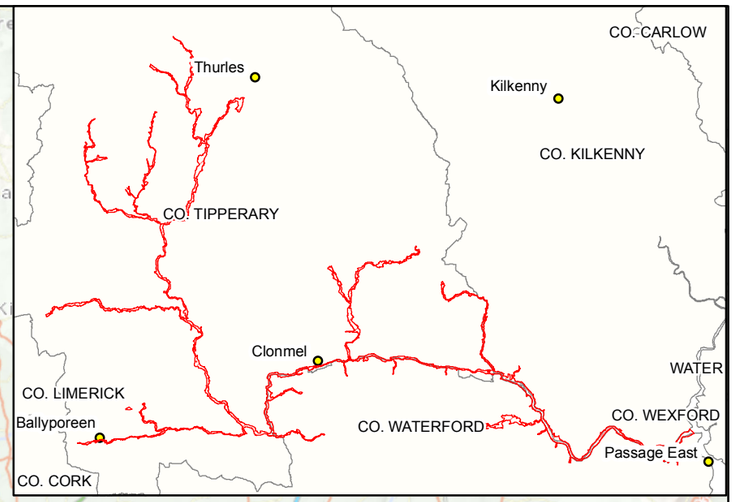
1355 Otter *Lutra lutra*

To maintain the favourable conservation condition of Otter in Lower River Suir SAC, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Distribution	Percentage positive survey sites	No significant decline	Measure based on standard otter survey technique. Favourable Conservation Status (FCS) target, based on 1980/81 survey findings, is 88% in SACs. Current range is estimated at 93.6% (Reid et al. 2013)
Extent of terrestrial habitat	Hectares	No significant decline. Area mapped and calculated as 116.17ha above high water mark (HWM) and 726.61ha along river banks	No field survey. Areas mapped to include 10m terrestrial buffer along shoreline (above HWM and along river banks) identified as critical for otters (NPWS, 2007)
Extent of marine habitat	Hectares	No significant decline. Area mapped and calculated as 712.27ha	No field survey. Area mapped based on evidence that otters tend to forage within 80m of the shoreline (HWM) (Kruuk, 2006; NPWS, 2007)
Extent of freshwater (river) habitat	Kilometres	No significant decline. Length mapped and calculated as 382.31km	No field survey. River length calculated on the basis that otters will utilise freshwater habitats from estuary to headwaters (Chapman and Chapman, 1982)
Couching sites and holts	Number	No significant decline	Otters need lying up areas throughout their territory where they are secure from disturbance (Kruuk and Moorhouse, 1991; Kruuk, 2006)
Fish biomass available	Kilograms	No significant decline	Broad diet that varies locally and seasonally, but dominated by fish, in particular salmonids, eels and sticklebacks in freshwater (Bailey and Rochford, 2006; Reid et al., 2013) and wrasse and rockling in coastal waters (Kingston et al., 1999)
Barriers to connectivity	Number	No significant increase	Otters will regularly commute across stretches of open water up to 500m e.g. between the mainland and an island; between two islands; across an estuary (De Jongh and O'Neill, 2010). It is important that such commuting routes are not obstructed

Legend

Lower River Suir SAC 002137



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MAP 1:
LOWER RIVER SUIR SAC
CONSERVATION OBJECTIVES
SAC DESIGNATION

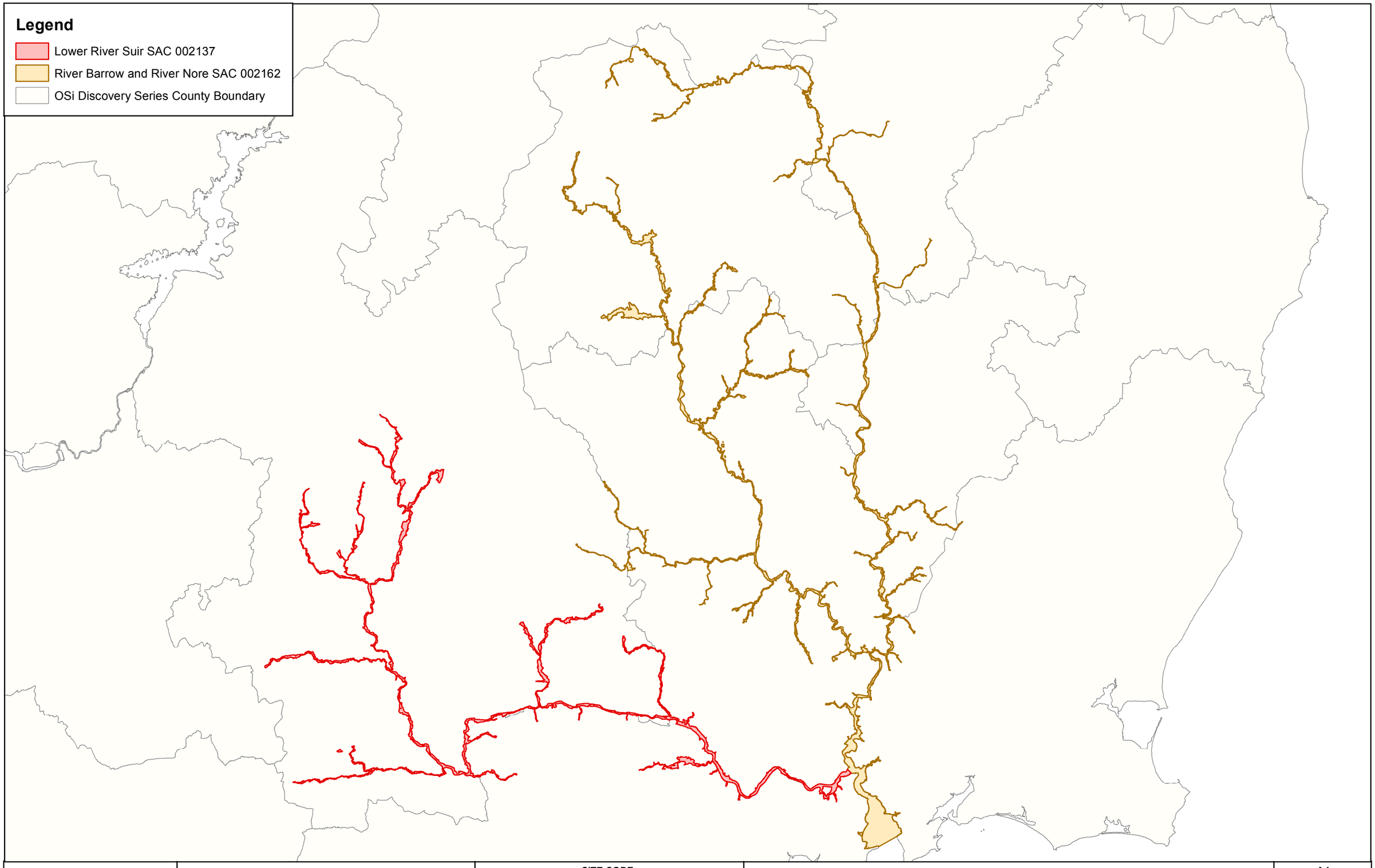
Map to be read in conjunction with the NPWS Conservation Objectives Document.

SITE CODE: SAC 002137; version 3.
CO. WATERFORD, CO. LIMERICK, CO.TIPPERARY, CO. KILKENNY

0 3 6 9 12 15 km

N

Map Version 1
Date: Oct 2016



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MAP 2:
LOWER RIVER SUIR SAC
CONSERVATION OBJECTIVES
ADJOINING DESIGNATION

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

SITE CODE:
SAC 002137; version 3. SAC 002162; version 3.01
CO. WATERFORD, CO. LIMERICK, CO.TIPPERARY, CO. KILKENNY

0 6 12 18 24 30 km

N

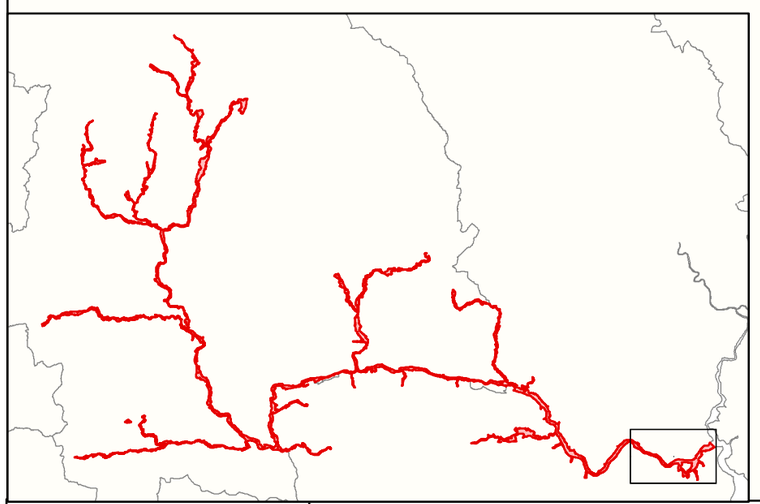
Map Version 1
Date: Oct 2016

Legend

- Lower River Suir SAC 002137
- Saltmarsh Monitoring Project Survey Area

Annex I Saltmarsh Habitats

- 1330 Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*)
- Potential 1330 Potential Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*)
- OSi Discovery Series County Boundary



SMP Site Code: SMP0052

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MAP 3:
LOWER RIVER SUIR SAC
CONSERVATION OBJECTIVES
SALTMARSH HABITATS

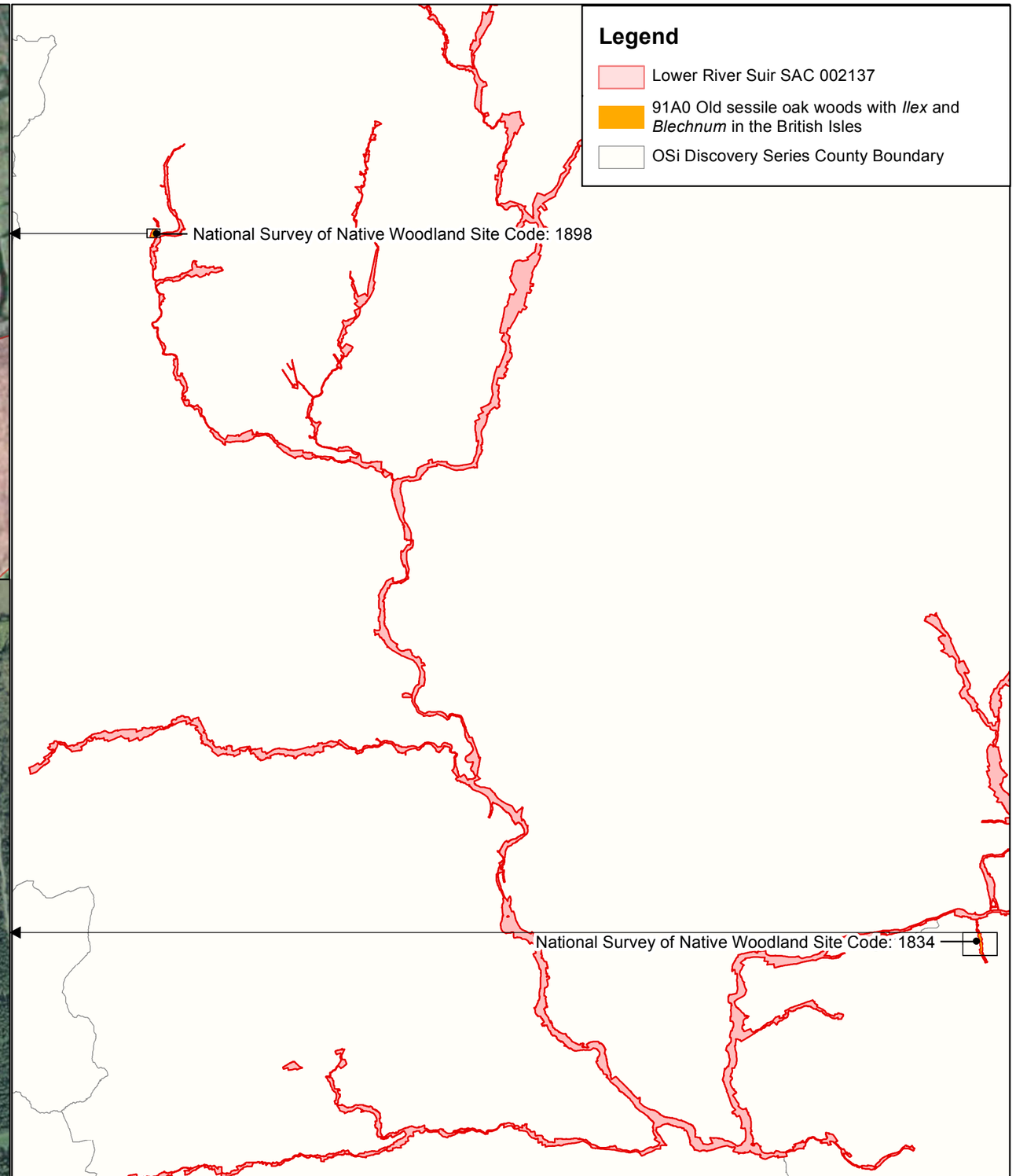
Map to be read in conjunction with the NPWS Conservation Objectives Document.

SITE CODE:
SAC 002137; version 3.
CO. WATERFORD, CO. LIMERICK, CO.TIPPERARY, CO. KILKENNY

0 0.3 0.6 0.9 1.2 1.5 km

N

Map Version 1
Date: Oct 2016



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MAP 4:
LOWER RIVER SUIR SAC
CONSERVATION OBJECTIVES
OLD SESSILE OAK WOODLAND

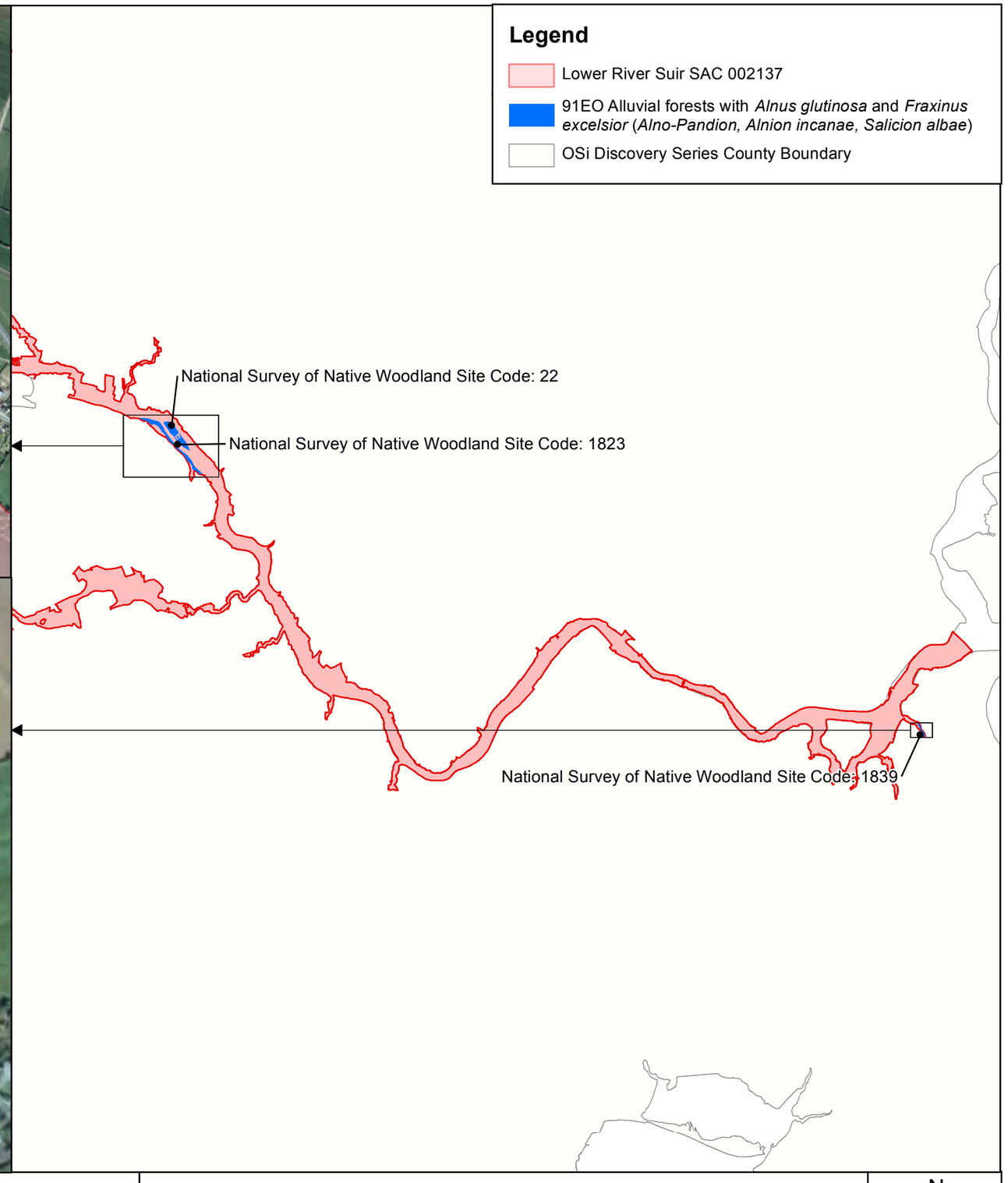
Map to be read in conjunction with the NPWS Conservation Objectives Document.

SITE CODE:
SAC 002137; version 3.
CO. WATERFORD, CO. LIMERICK, CO.TIPPERARY, CO. KILKENNY

0 0.035 0.07 0.105 0.14 0.175 km

N

Map Version 1
Date: Oct 2016



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MAP 5:
LOWER RIVER SUIR SAC
CONSERVATION OBJECTIVES
ALLUVIAL WOODLAND

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

SITE CODE: SAC 002137; version 3.
CO. WATERFORD, CO. LIMERICK, CO.TIPPERARY, CO. KILKENNY

0 0.15 0.3 0.45 0.6 0.75 km

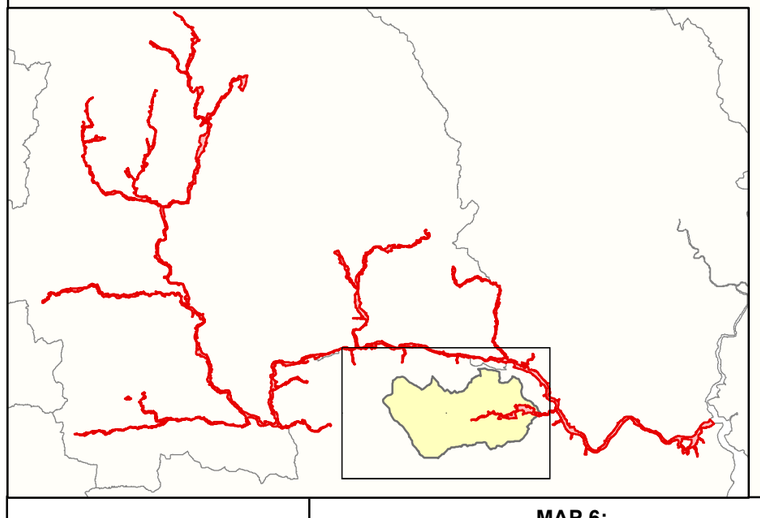
N

Map Version 1
Date: Oct 2016

Legend

- Lower River Suir SAC 002137
- 1029 Freshwater Pearl Mussel *Margaritifera margaritifera* Suitable habitat length
- 1029 Freshwater Pearl Mussel *Margaritifera margaritifera* Distribution target
- 1029 Freshwater Pearl Mussel *Margaritifera margaritifera* Catchment
- OSi Discovery Series County Boundary

Clodiagh Catchment



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MAP 6:
LOWER RIVER SUIR SAC
CONSERVATION OBJECTIVES
FRESHWATER PEARL MUSSEL -
MARGARITIFERA MARGARITIFERA

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

SITE CODE:
SAC 002137; version 3.
CO. WATERFORD, CO. LIMERICK, CO.TIPPERARY, CO. KILKENNY

0 0.8 1.6 2.4 3.2 4 km

N

Map Version 1
Date: Oct 2016

Legend

- Lower River Suir SAC 002137
- 1092 White-clawed Crayfish *Austropotamobius pallipes*
- OSi Discovery Series County Boundary

An Roinn Ealaíon, Oidhreachta, Gnóthaí Réigiúnacha, Tuaithe agus Gaeltachta

Department of Arts, Heritage, Regional, Rural and Gaeltacht Affairs

MAP 7:
LOWER RIVER SUIR SAC
CONSERVATION OBJECTIVES
WHITE-CLAWED CRAYFISH

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

SITE CODE:
SAC 002137; version 3.
CO. WATERFORD, CO. LIMERICK, CO.TIPPERARY, CO. KILKENNY

0 3 6 9 12 15 km

N

Map Version 1
Date: Oct 2016

National Parks and Wildlife Service

Conservation Objectives

River Barrow and River Nore SAC 002162

An Roinn
Ealaíon, Oidhreachta agus Gaeltachta
Department of
Arts, Heritage and the Gaeltacht

Introduction

The overall aim of the Habitats Directive is to maintain or restore the favourable conservation status of habitats and species of community interest. These habitats and species are listed in the Habitats and Birds Directives and Special Areas of Conservation and Special Protection Areas are designated to afford protection to the most vulnerable of them. These two designations are collectively known as the Natura 2000 network.

European and national legislation places a collective obligation on Ireland and its citizens to maintain habitats and species in the Natura 2000 network at favourable conservation condition. The Government and its agencies are responsible for the implementation and enforcement of regulations that will ensure the ecological integrity of these sites.

A site-specific conservation objective aims to define favourable conservation condition for a particular habitat or species at that site.

The maintenance of habitats and species within Natura 2000 sites at favourable conservation condition will contribute to the overall maintenance of favourable conservation status of those habitats and species at a national level.

Favourable conservation status of a habitat is achieved when:

- its natural range, and area it covers within that range, are stable or increasing, and
- the specific structure and functions which are necessary for its long-term maintenance exist and are likely to continue to exist for the foreseeable future, and
- the conservation status of its typical species is favourable.

The favourable conservation status of a species is achieved when:

- population dynamics data on the species concerned indicate that it is maintaining itself on a long-term basis as a viable component of its natural habitats, and
- the natural range of the species is neither being reduced nor is likely to be reduced for the foreseeable future, and
- there is, and will probably continue to be, a sufficiently large habitat to maintain its populations on a long-term basis.

Notes/Guidelines:

1. The targets given in these conservation objectives are based on best available information at the time of writing. As more information becomes available, targets for attributes may change. These will be updated periodically, as necessary.
2. An appropriate assessment based on these conservation objectives will remain valid even if the targets are subsequently updated, providing they were the most recent objectives available when the assessment was carried out. It is essential that the date and version are included when objectives are cited.
3. Assessments cannot consider an attribute in isolation from the others listed for that habitat or species, or for other habitats and species listed for that site. A plan or project with an apparently small impact on one attribute may have a significant impact on another.
4. Please note that the maps included in this document do not necessarily show the entire extent of the habitats and species for which the site is listed. This should be borne in mind when appropriate assessments are being carried out.
5. When using these objectives, it is essential that the relevant backing/supporting documents are consulted, particularly where instructed in the targets or notes for a particular attribute.

Qualifying Interests

**** indicates a priority habitat under the Habitats Directive***

002162 River Barrow and River Nore SAC

QI	Description
1016	Desmoulin's whorl snail *Vertigo moulinsiana*
1029	Freshwater pearl mussel *Margaritifera margaritifera*
1092	White-clawed crayfish *Austropotamobius pallipes*
1095	Sea lamprey *Petromyzon marinus*
1096	Brook lamprey *Lampetra planeri*
1099	River lamprey *Lampetra fluviatilis*
1103	Twaite shad *Alosa fallax*
1106	Atlantic salmon (*Salmo salar*) (only in fresh water)
1130	Estuaries
1140	Mudflats and sandflats not covered by seawater at low tide
1310	*Salicornia* and other annuals colonizing mud and sand
1330	Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*)
1355	Otter *Lutra lutra*
1410	Mediterranean salt meadows (*Juncetalia maritimi*)
1421	Killarney fern *Trichomanes speciosum*
1990	Nore freshwater pearl mussel *Margaritifera durrovensis*
3260	Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation
4030	European dry heaths
6430	Hydrophilous tall herb fringe communities of plains and of the montane to alpine levels
7220	* Petrifying springs with tufa formation (*Cratoneurion*)
91A0	Old sessile oak woods with *Ilex* and *Blechnum* in the British Isles
91E0	* Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (*Alno-Padion*, *Alnion incanae*, *Salicion albae*)

Supporting documents, relevant reports & publications (listed by date)

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

Title: Desmoulin's whorl snail (*Vertigo moulinsiana* - 1016) Conservation Status Assessment Report
Year: 2011
Author: Moorkens, E. ; Killeen, I.
Series: Unpublished Report to NPWS

Title: River Barrow and River Nore SAC (002162): Conservation objectives supporting document - woodland habitats [Version 1]
Year: 2011
Author: NPWS
Series: Unpublished Report to NPWS

Title: River Barrow and River Nore SAC (002162): Conservation objectives supporting document - coastal habitats [Version 1]
Year: 2011
Author: NPWS
Series: Unpublished Report to NPWS

Title: River Barrow and River Nore SAC (002162): Conservation objectives supporting document - marine habitats [Version 1]
Year: 2011
Author: NPWS
Series: Unpublished Report to NPWS

Title: Second Draft Nore Freshwater Pearl Mussel Sub-basin Management Plan (2009-2015)
Year: 2010
Author: DEHLG
Series: Unpublished Report to NPWS

Title: Site investigations for *Sabellaria alveolata* (Honey-comb worm) biogenic reefs in Ireland
Year: 2010
Author: NPWS
Series: Unpublished Report to NPWS

Title: Irish Semi-natural Grasslands Survey. Annual report no. 3: Counties Donegal, Dublin, Kildare & Sligo
Year: 2010
Author: O'Neill, F.H.; Martin, J.R.; Devaney, F.M.; McNutt, K.E.; Perrin, P.M. ; Delaney, A.
Series: Unpublished Report to NPWS

Title: A provisional inventory of ancient and long-established woodland in Ireland
Year: 2010
Author: Perrin, P.M.; Daly, O.H.
Series: Irish Wildlife Manuals No. 46

Title: Guidelines for a national survey and conservation assessment of upland vegetation and habitats in Ireland [Version 1.0]
Year: 2010
Author: Perrin, P.M.; Barron, S.J.; Roche, J.R.; O'Hanrahan, B.
Series: Irish Wildlife Manuals No. 48

Title: A technical manual for monitoring white-clawed crayfish *Austropotamobius pallipes* in Irish lakes

Year: 2010

Author: Reynolds, J.D.; O'Connor, W.; O'Keeffe, C.; Lynn, D.

Series: Irish Wildlife Manuals No. 45

Title: Report of the standing scientific committee to the DCENR. The status of Irish salmon stocks in 2010 and precautionary catch advice for 2011

Year: 2010

Author: SSC

Series: Unpublished Report to DCENR

Title: The European Communities Environmental Objectives (Freshwater Pearl Mussel) Regulations 2009. [S.I. 296 of 2009]

Year: 2009

Author: Government of Ireland

Series: Irish Statute Book

Title: The European Communities Environmental Objectives (Surface Water) Regulations 2009. [S.I. 272 of 2009]

Year: 2009

Author: Government of Ireland

Series: Irish Statute Book

Title: Saltmarsh Monitoring Report 2007-2008

Year: 2009

Author: McCorry, M.; Ryle, T.

Series: Unpublished Report to NPWS

Title: *Margaritifera durrovensis* Survey of Nore River. June – July 2009. NS 2 project

Year: 2009

Author: Moorkens, E. A.

Series: Unpublished Report to NPWS

Title: Benthic Biotope classification of subtidal sedimentary habitats in the Lower River Suir candidate Special Area of Conservation and the River Nore and River Barrow candidate Special Area of Conservation

Year: 2008

Author: ARMS

Series: Unpublished Report to NPWS

Title: A survey of mudflats and sandflats in Ireland. An intertidal soft sediment survey of Waterford Estuary

Year: 2008

Author: ASU

Series: Unpublished Report to NPWS

Title: Assessment of the Risk of Barriers to Fish Migration in the Nore Catchment, Southern Regional Fisheries Board

Year: 2008

Author: CFB; Compass Informatics

Series: Unpublished Report to CFB

Title: Poor water quality constrains the distribution and movements of Twaite shad *Alosa fallax fallax* (Lacepede, 1803) in the watershed of river Scheldt

Year: 2008

Author: Maas, J.; Stevens, M. ; Breine, J.

Series: Hydrobiologia 602, 129 - 143

Title: All Ireland Species Action Plan - Killarney fern

Year: 2008

Author: NPWS ; EHS-NI

Series: Unpublished Report to NPWS & EHS-NI

Title: National Survey of Native Woodlands 2003-2008

Year: 2008

Author: Perrin, P.; Martin, J.; Barron, S.; O'Neill, F.; McNutt, K.; Delaney, A.

Series: Unpublished Report to NPWS

Title: Saltmarsh Monitoring Report 2006

Year: 2007

Author: McCorry, M.

Series: Unpublished Report to NPWS

Title: Supporting documentation for the Habitats Directive Conservation Status Assessment - backing documents, Article 17 forms and supporting maps

Year: 2007

Author: NPWS

Series: Unpublished Report to NPWS

Title: A Survey of Juvenile Lamprey Populations in the Corrib and Suir Catchments

Year: 2007

Author: O'Connor, W.

Series: Irish Wildlife Manuals No. 26

Title: Assessment of fish passage and the ecological impact of migration barriers on the River Nore catchment

Year: 2007

Author: Sullivan, A.

Series: Nore Suir Rivers Trust & OPW

Title: Otter Survey of Ireland 2004/2005

Year: 2006

Author: Bailey, M.; Rochford, J.

Series: Irish Wildlife Manuals No. 23

Title: The status of host fish populations and fish species richness in European freshwater pearl mussel (*Margaritifera margaritifera*) streams

Year: 2006

Author: Geist, J.; Porkka, M.; Kuehn, R.

Series: Aquatic Conservation: Marine and Freshwater Ecosystems 16, 251–266

Title: The distribution of Lamprey in the River Barrow SAC

Year: 2006

Author: King, J.J.

Series: Irish Wildlife Manuals No. 21

Title: Otters - ecology, behaviour and conservation

Year: 2006

Author: Kruuk, H.

Series: Oxford University Press

Title: The ecology and conservation of the gametophyte generation of the Killarney Fern (*Trichomanes speciosum* Willd.) in Ireland

Year: 2005

Author: Kingston, N. ; Hayes, C.

Series: Biology and Environment: Proceedings of the Royal Irish Academy 105B(2): 71-79

Title: Pilot Project for Monitoring Populations of the Freshwater Pearl Mussel. Baseline survey of the Nore River SAC, Counties Laois and Kilkenny

Year: 2004

Author: Moorkens, E. A.

Series: Unpublished Report to NPWS

Title: Monitoring the river, sea and brook lamprey, *Lampetra fluviatilis*, *L. planeri* and *Petromyzon marinus*

Year: 2003

Author: Harvey, J.; Cowx, I.

Series: Conserving Natura 2000 Rivers Monitoring Series No. 5, English Nature, Peterborough

---

Title: Ecology of Watercourses Characterised by *Ranunculion fluitantis* and *Callitricho-Batrachion* Vegetation

Year: 2003

Author: Hatton-Ellis, T.W.; Grieve, N.

Series: Conserving Natura 2000 Rivers Ecology Series No. 11. English Nature, Peterborough.

Title: Ecology of the Allis and Twaite shad

Year: 2003

Author: Maitland, P.S.; Hatton-Ellis, T.W.

Series: Conserving Natura 2000 Rivers Ecology Series No. 3. English Nature, Peterborough

---

Title: A survey of the white-clawed crayfish, *Austropotamobius pallipes* (Lereboullet) and of water quality in two catchments of Eastern Ireland

Year: 2002

Author: Demers, A.; Reynolds, J. D.

Series: Bulletin Français de la Pêche et de la Pisciculture, 367: 729-740

Title: Reversing the habitat fragmentation of British woodlands

Year: 2002

Author: Peterken, G.

Series: WWF-UK, London

Title: A survey of broadleaf woodlands in 3 SACs: Barrow-Nore, River Unshin & Lough Forbes

Year: 2000

Author: Browne, A.; Dunne, F.; Roche, N.

Series: Unpublished Report to NPWS

Title: Diet of Otters *Lutra lutra* on Inishmore, Aran Islands, west coast of Ireland

Year: 1999

Author: Kingston, S.; O'Connell, M.; Fairley, J.S.

Series: Biol & Environ Proc R Ir Acad B 99B:173–182

Title:	Conservation Management of the White-clawed Crayfish, *Austropotamobius pallipes*
Year:	1998
Author:	Reynolds, J.D.
Series:	Irish Wildlife Manuals No. 1
Title:	Studies on the biology and ecology of Margaritifera in Ireland
Year:	1996
Author:	Moorkens, E.A.
Series:	Unpublished PhD thesis, University of Dublin, Trinity College.
Title:	Imminent extinction of the Nore freshwater pearl mussel *Margaritifera durrovensis* Phillips: a species unique to Ireland
Year:	1994
Author:	Moorkens, E.A. ; Costello, M.J.
Series:	Aquatic Conservation: Marine and Freshwater Ecosystems 4,363-365
Title:	The spatial organization of otters (*Lutra lutra*) in Shetland
Year:	1991
Author:	Kruuk, H.; Moorhouse, A.
Series:	J. Zool, 224: 41-57
Title:	The vegetation of Irish rivers
Year:	1987
Author:	Heuff, H.
Series:	Unpublished Report
Title:	Otter survey of Ireland
Year:	1982
Author:	Chapman, P.J.; Chapman, L.L.
Series:	Unpublished Report to Vincent Wildlife Trust

Spatial data sources

Year:	2010
Title:	EPA transitional waterbody data
GIS operations:	Clipped to SAC boundary
Used for:	1130 (map 2)

Year:	Interpolated 2011
Title:	Intertidal and subtidal surveys 2008 & 2010
GIS operations:	Polygon feature classes from marine community types base data sub-divided based on interpolation of marine survey data
Used for:	Marine community types, 1140 (maps 3 & 4)

Year:	2005
Title:	OSi Discovery series vector data
GIS operations:	High water mark (HWM) and low water mark (LWM) polyline feature classes converted into polygon feature classes and combined; Saltmarsh and Sand Dune datasets erased out if applicable
Used for:	Marine community types base data (map 4)

Year:	Revision 2010
Title:	Saltmarsh Monitoring Project 2007-2008. Version 1
GIS operations:	QIs selected; clipped to SAC boundary; overlapping regions with Sand Dune data investigated and resolved with expert opinion used
Used for:	1310, 1330, 1410 (map 5)

Year:	Derived 2011
Title:	Internal NPWS files
GIS operations:	Dataset created from spatial reference contained in files
Used for:	7220 (map 6)

Year:	Revision 2010
Title:	National Survey of Native Woodlands 2003-2008. Version 1
GIS operations:	QIs selected; clipped to SAC boundary
Used for:	91A0, 91E0 (map 6)

Year:	2011
Title:	NPWS rare and threatened species database
GIS operations:	Dataset created from spatial references in database records
Used for:	1016, 1092, 1421, 1990 (map 7)

Year:	2005
Title:	OSi Discovery series vector data
GIS operations:	Creation of an 80m buffer on the marine side of the high water mark (HWM); creation of a 10m buffer on the terrestrial side of the HWM; combination of 80m and 10m HWM buffer datasets; creation of a 10m buffer on the landward side of the river banks data; creation of a 20m buffer applied to river centerline and stream data; combination of 10m river banks and 20m river and stream centerline buffer datasets; combined river and stream buffer dataset clipped to HWM; combination of HWM buffer dataset with river and stream buffer dataset; overlapping regions investigated and resolved; resulting dataset clipped to SAC boundary
Used for:	1355 (no map)

1016 Desmoulin's whorl snail *Vertigo moulinsiana*

To maintain the favourable conservation condition of Desmoulin's whorl snail in the River Barrow and River Nore SAC, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Distribution: occupied sites	Number	No decline. Two known sites: Borris Bridge, Co. Carlow S711503; Boston Bridge, Kilnaseer S338774, Co. Laois. See map 7	Data from NPWS rare and threatened species database
Population size: adults	Number per positive sample	At least 5 adults snails in at least 50% of samples	Attribute and target from Moorkens and Killeen (2011)
Population density	Percentage positive samples	Adult snails present in at least 60% of samples per site	Attribute and target from Moorkens and Killeen (2011)
Area of occupancy	Hectares	Minimum of 1ha of suitable habitat per site	Attribute and target from Moorkens and Killeen (2011)
Habitat quality: vegetation	Percentage of samples with suitable vegetation	90% of samples in habitat classes I and II as defined in Moorkens & Killeen (2011)	Attribute and target from Moorkens and Killeen (2011)
Habitat quality: soil moisture levels	Percentage of samples with appropriate soil moisture levels	90% of samples in moisture class 3-4 as defined in Moorkens & Killeen (2011)	Attribute and target from Moorkens and Killeen (2011)

1029 Freshwater pearl mussel *Margaritifera margaritifera*

The status of the freshwater pearl mussel (*Margaritifera margaritifera*) as a qualifying Annex II species for the River Barrow and River Nore SAC is currently under review. The outcome of this review will determine whether a site-specific conservation objective is set for this species. Please note that the Nore freshwater pearl mussel (*Margaritifera durrovensis*) remains a qualifying species for this SAC. This document contains a conservation objective for the latter species.

1092 White-clawed crayfish *Austropotamobius pallipes*

To maintain the favourable conservation condition of White-clawed crayfish in the River Barrow and River Nore SAC, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Distribution	Occurrence	No reduction from baseline. See map 7	The crayfish is present almost throughout this SAC. The records extend as far downstream as Thomastown on the Nore and Graiguenamanagh on the Barrow
Population structure: recruitment	Percentage occurrence of juveniles and females with eggs	Juveniles and/or females with eggs in at least 50% of positive samples	See Reynolds et al. (2010) for further details
Negative indicator species	Occurrence	No alien crayfish species	Alien crayfish species are identified as major direct threat to this species and as disease vector. See Reynolds (1998) for further details
Disease	Occurrence	No instances of disease	Disease is identified as major threat and has occurred in Ireland even in the absence of alien vectors. See Reynolds (1998) for further details
Water quality	EPA Q value	At least Q3-4 at all sites sampled by EPA	Target taken from Demers and Reynolds (2002). Q values based on triennial water quality surveys carried out by the Environmental Protection Agency (EPA)
Habitat quality: heterogeneity	Occurrence of positive habitat features	No decline in heterogeneity or habitat quality	Crayfish need high habitat heterogeneity. Larger crayfish must have stones to hide under, or an earthen bank in which to burrow. Hatchlings shelter in vegetation, gravel and among fine tree-roots. Smaller crayfish are typically found among weed and debris in shallow water. Larger juveniles in particular may also be found among cobbles and detritus such as leaf litter. These conditions must be available on the whole length of occupied habitat

1095 Sea lamprey *Petromyzon marinus*

To restore the favourable conservation condition of Sea lamprey in the River Barrow and River Nore SAC, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Distribution: extent of anadromy	% of river accessible	Greater than 75% of main stem length of rivers accessible from estuary	Artificial barriers can block or cause difficulties to lampreys' upstream migration, thereby limiting species to lower stretches and restricting access to spawning areas. See King (2006), Sullivan (2007) and CFB and Compass Informatics (2008) for further information on artificial barriers
Population structure of juveniles	Number of age/size groups	At least three age/size groups present	Attribute and target based on data from Harvey and Cowx (2003) and O'Connor, (2007). King (2007) provides survey information for the Barrow
Juvenile density in fine sediment	Juveniles/m²	Juvenile density at least 1/m²	Juveniles burrow in areas of fine sediment in still water. Attribute and target based on data from Harvey and Cowx (2003)
Extent and distribution of spawning habitat	m² and occurrence	No decline in extent and distribution of spawning beds	Attribute and target based on spawning bed mapping by Inland Fisheries Ireland (IFI). Lampreys spawn in clean gravels. Artificial barriers are currently preventing lamprey from accessing suitable spawning habitat. See King (2006), Sullivan (2007) and CFB and Compass Informatics (2008) for further information
Availability of juvenile habitat	Number of positive sites in 3rd order channels (and greater), downstream of spawning areas	More than 50% of sample sites positive	Artificial barriers are currently preventing juvenile lampreys from accessing the full extent of suitable habitat. See King (2006), Sullivan (2007) and CFB and Compass Informatics (2008) for further information

1096 Brook lamprey *Lampetra planeri*

To restore the favourable conservation condition of Brook lamprey in the River Barrow and River Nore SAC, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Distribution	% of river accessible	Access to all watercourses down to first order streams	Artificial barriers can block lampreys' upstream migration, thereby limiting species to lower stretches and restricting access to spawning areas. See King (2006), Sullivan (2007) and CFB and Compass Informatics (2008) for further information on artifical barriers
Population structure of juveniles	Number of age/size groups	At least three age/size groups of brook/river lamprey present	Attribute and target based on data from Harvey and Cowx (2003). King (2007) provides survey information for the Barrow. It is impossible to distinguish between brook and river lamprey juveniles in the field, hence they are considered together in this target
Juvenile density in fine sediment	Juveniles/m²	Mean catchment juvenile density of brook/river lamprey at least 2/m²	Juveniles burrow in areas of fine sediment in still water. Attribute and target based on data from Harvey and Cowx (2003) who state 10/m² in optimal conditions and more than 2/m² on a catchment basis
Extent and distribution of spawning habitat	m² and occurrence	No decline in extent and distribution of spawning beds	Attribute and target based on spawning bed mapping by Inland Fisheries Ireland (IFI). Lampreys spawn in clean gravels. Artificial barriers are currently preventing lamprey from accessing suitable spawning habitat. See King (2006), Sullivan (2007) and CFB and Compass Informatics (2008) for further information
Availability of juvenile habitat	Number of positive sites in 2nd order channels (and greater), downstream of spawning areas	More than 50% of sample sites positive	Artificial barriers are currently preventing juvenile lampreys from accessing the full extent of suitable habitat. See King (2006), Sullivan (2007) and CFB and Compass Informatics (2008) for further information

1099 River lamprey *Lampetra fluviatilis*

To restore the favourable conservation condition of River lamprey in the River Barrow and River Nore SAC, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Distribution: extent of anadromy	% of river accessible	Greater than 75% of main stem and major tributaries down to second order accessible from estuary	Artificial barriers can block lampreys' upstream migration, thereby limiting species to lower stretches and restricting access to spawning areas. See King (2006), Sullivan (2007) and CFB and Compass Informatics (2008) for further information on artificial barriers
Population structure of juveniles	Number of age/size groups	At least three age/size groups of river/brook lamprey present	Attribute and target based on data from Harvey and Cowx (2003). King (2007) provides survey information for the Barrow. It is impossible to distinguish between brook and river lamprey juveniles in the field, hence they are considered together in this target
Juvenile density in fine sediment	Juveniles/m²	Mean catchment juvenile density of brook/river lamprey at least 2/m²	Juveniles burrow in areas of fine sediment in still water. Attribute and target based on data from Harvey and Cowx (2003) who state 10/m² in optimal conditions and more than 2/m² on a catchment basis
Extent and distribution of spawning habitat	m² and occurrence	No decline in extent and distribution of spawning beds	Attribute and target based on spawning bed mapping by Inland Fisheries Ireland (IFI). Lampreys spawn in clean gravels. Artificial barriers are currently preventing lamprey from accessing suitable spawning habitat. See King (2006), Sullivan (2007) and CFB and Compass Informatics (2008) for further information
Availability of juvenile habitat	Number of positive sites in 2nd order channels (and greater), downstream of spawning areas	More than 50% of sample sites positive	Artificial barriers are currently preventing juvenile lampreys from accessing the full extent of suitable habitat. See King (2006), Sullivan (2007) and CFB and Compass Informatics (2008) for further information

1103 Twaite shad *Alosa fallax*

To restore the favourable conservation condition of Twaite shad in the River Barrow and River Nore SAC, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Distribution: extent of anadromy	% of river accessible	Greater than 75% of main stem length of rivers accessible from estuary	In some catchments, artificial barriers block twaite shads' upstream migration, thereby limiting species to lower stretches and restricting access to spawning areas
Population structure: age classes	Number of age classes	More than one age class present	Regular breeding has been confirmed in the River Barrow in recent years, but not in the Nore
Extent and distribution of spawning habitat	m^2 and occurrence	No decline in extent and distribution of spawning habitats	
Water quality: oxygen levels	Milligrammes per litre	No lower than 5mg/l	Attribute and target based on Maas, Stevens and Briene (2008)
Spawning habitat quality: Filamentous algae; macrophytes; sediment	Occurrence	Maintain stable gravel substrate with very little fine material, free of filamentous algal (macroalgae) growth and macrophyte (rooted higher plants) growth	See Maitland and Hatton-Ellis (2003) for further information

1106 Atlantic salmon (*Salmo salar*) (only in fresh water)

To restore the favourable conservation condition of Salmon in the River Barrow and River Nore SAC, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Distribution: extent of anadromy	% of river accessible	100% of river channels down to second order accessible from estuary	Artificial barriers block salmons' upstream migration, thereby limiting species to lower stretches and restricting access to spawning areas. See Sullivan (2007) and CFB and Compass Informatics (2008) for further information on artificial barriers
Adult spawning fish	Number	Conservation Limit (CL) for each system consistently exceeded	A conservation limit is defined by the North Atlantic Salmon Conservation Organisation (NASCO) as "the spawning stock level that produces long-term average maximum sustainable yield as derived from the adult to adult stock and recruitment relationship". The target is based on the Standing Scientific Committee of the National Salmon Commission's annual model output of CL attainment levels. See SSC (2010). Stock estimates are either derived from direct counts of adults (rod catch, fish counter) or indirectly by fry abundance counts. The Nore is currently exceeding its CL, while the Barrow is below its CL
Salmon fry abundance	Number of fry/5 minutes electrofishing	Maintain or exceed 0+ fry mean catchment-wide abundance threshold value. Currently set at 17 salmon fry/5 min sampling	Target is threshold value for rivers currently exceeding their conservation limit (CL)
Out-migrating smolt abundance	Number	No significant decline	Smolt abundance can be negatively affected by a number of impacts such as estuarine pollution, predation and sea lice (*Lepeophtheirus salmonis*)
Number and distribution of redds	Number and occurrence	No decline in number and distribution of spawning redds due to anthropogenic causes	Salmon spawn in clean gravels. Artificial barriers are currently preventing salmon from accessing suitable spawning habitat
Water quality	EPA Q value	At least Q4 at all sites sampled by EPA	Q values based on triennial water quality surveys carried out by the Environmental Protection Agency (EPA)

1130 Estuaries

To maintain the favourable conservation condition of Estuaries in the River Barrow and River Nore 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. See map 2	Habitat area was estimated using OSI data and the defined Transitional Water Body area under the Water Framework Directive as 3856ha. See marine supporting document for further details
Community distribution	Hectares	The following sediment communities should be maintained in a natural condition: Muddy estuarine community complex; Sand to muddy fine sand community complex; Fine sand with *Fabulina fabula* community. See map 4	The likely area of sediment communities was derived from a combination of intertidal and subtidal surveys undertaken in 2008 (ARMS, 2008; ASU, 2008). See marine supporting document for further details
Community extent	Hectares	Maintain the natural extent of the Sabellaria alveolata reef, subject to natural process. See map 4	The likely area of this community is derived from a survey undertaken in 2010 (NPWS, 2010). See marine supporting document for further details

1140 Mudflats and sandflats not covered by seawater at low tide

To maintain the favourable conservation condition of the Mudflats and sandflats not covered by seawater at low tide in the River Barrow and River Nore 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. See map 3	Habitat area was estimated using OSI data as 926ha. See marine supporting document for further details
Community distribution	Hectares	The following sediment communities should be maintained in a natural condition: Muddy estuarine community complex; Sand to muddy fine sand community complex. See map 4	The likely area of sediment communities was derived from a combination of intertidal and subtidal surveys undertaken in 2008 (ARMS, 2008; ASU, 2008). See marine supporting document for further details

1310 *Salicornia* and other annuals colonizing mud and sand

To maintain the favourable conservation condition of *Salicornia* and other annuals colonizing mud and sand in the River Barrow and River Nore 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 the one sub-site mapped: Ringville - 0.03ha. See map 5	Based on data from the Saltmarsh Monitoring Project (McCorry and Ryle, 2009). The Ringville sub-site was mapped and no additional areas of potential Salicornia mudflat were identified from an examination of aerial photographs, giving a total estimated area of 0.03ha. NB futher unsurveyed areas maybe present within the site. See coastal habitats supporting document for further details
Habitat distribution	Occurrence	No decline, subject to natural processes. See map 5	See coastal habitats supporting document for further details
Physical structure: sediment supply	Presence/absence of physical barriers	Maintain or where necessary restore natural circulation of sediments and organic matter, without any physical obstructions	See coastal habitats supporting document for further details
Physical structure: flooding regime	Hectares flooded; frequency	Maintain natural tidal regime	See coastal habitats supporting document for further details
Physical structure: creeks and pans	Occurrence	Maintain/restore creek and pan structure, subject to natural processes, including erosion and succession	Based on McCorry and Ryle (2009). See coastal habitats supporting document for further details
Vegetation structure: zonation	Occurrence	Maintain range of saltmarsh habitat zonations including transitional zones, subject to natural processes including erosion and succession. See map 5	Based on McCorry and Ryle (2009). See coastal habitats supporting document for further details
Vegetation structure: vegetation height	Centimetres	Maintain structural variation within sward	Based on McCorry and Ryle (2009). See coastal habitats supporting document for further details
Vegetation structure: vegetation cover	Percentage cover at a representative sample of monitoring stops	Maintain more than 90% of area outside creeks vegetated.	Based on McCorry and Ryle (2009). See coastal habitats supporting document for further details
Vegetation composition: typical species and sub-communities	Percentage cover at a representative sample of monitoring stops	Maintain range of sub-communities with typical species listed in Saltmarsh Monitoring Project (McCorry & Ryle, 2009).	See coastal habitats supporting document for further details
Vegetation structure: negative indicator species: *Spartina anglica*	Hectares	No significant expansion of *Spartina*. No new sites for this species and an annual spread of less than 1% where it is already known to occur	Based on McCorry and Ryle (2009). See coastal habitats supporting document for further details

1330 Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*)

To restore the favourable conservation condition of Atlantic salt meadows in the River Barrow and River Nore 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: Dunbrody Abbey - 1.25ha, Killowen - 2.59ha, Rochestown - 17.50ha, Ringville - 6.70ha. See map 5	Based on data from the Saltmarsh Monitoring Project (McCorry and Ryle, 2009). Four sub-sites were mapped and additional areas of potential saltmarsh were identified from an examination of aerial photographs, giving a total estimated area of Atlantic salt meadow of 35.07ha. NB futher unsurveyed areas maybe present within the site. See coastal habitats supporting document for further details
Habitat distribution	Occurrence	No decline, subject to natural processes. See map 5	See coastal habitats supporting document for further details
Physical structure: sediment supply	Presence/absence of physical barriers	Maintain/restore natural circulation of sediments and organic matter, without any physical obstructions	See coastal habitats supporting document for further details
Physical structure: flooding regime	Hectares flooded; frequency	Maintain natural tidal regime	See coastal habitats supporting document for further details
Physical structure: creeks and pans	Occurrence	Maintain/restore creek and pan structure, subject to natural processes, including erosion and succession	Based on McCorry and Ryle (2009). See coastal habitats supporting document for further details
Vegetation structure: zonation	Occurrence	Maintain range of saltmarsh habitat zonations including transitional zones, subject to natural processes including erosion and succession. See map 5	Based on McCorry and Ryle (2009). See coastal habitats supporting document for further details
Vegetation structure: vegetation height	Centimetres	Maintain structural variation within sward	Based on McCorry and Ryle (2009). See coastal habitats supporting document for further details
Vegetation structure: vegetation cover	Percentage cover at a representative sample of monitoring stops	Maintain more than 90% of area outside creeks vegetated	Based on McCorry and Ryle (2009). See coastal habitats supporting document for further details
Vegetation composition: typical species and sub-communities	Percentage cover at a representative sample of monitoring stops	Maintain range of sub-communities with typical species listed in Saltmarsh Monitoring Project (McCorry & Ryle, 2009)	See coastal habitats supporting document for further details
Vegetation structure: negative indicator species: *Spartina anglica*	Hectares	No significant expansion of *Spartina*. No new sites for this species and an annual spread of less than 1% where it is already known to occur	Based on McCorry and Ryle (2009). See coastal habitats supporting document for further details

1355 Otter *Lutra lutra*

To restore the favourable conservation condition of Otter in the River Barrow and River Nore SAC, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Distribution	Percentage positive survey sites	No significant decline	Measure based on standard otter survey technique. FCS target, based on 1980/81 survey findings, is 88% in SACs. Current range in south-east estimated at 73% (Bailey and Rochford, 2006)
Extent of terrestrial habitat	Hectares	No significant decline. Area mapped and calculated as 122.8ha above high water mark (HWM); 1136.0ha along river banks / around ponds	No field survey. Areas mapped to include 10m terrestrial buffer along shoreline (above HWM and along river banks) identified as critical for otters (NPWS, 2007)
Extent of marine habitat	Hectares	No significant decline. Area mapped and calculated as 857.7ha	No field survey. Area mapped based on evidence that otters tend to forage within 80m of the shoreline (HWM) (NPWS, 2007; Kruuk, 2006)
Extent of freshwater (river) habitat	Kilometres	No significant decline. Length mapped and calculated as 616.6km	No field survey. River length calculated on the basis that otters will utilise freshwater habitats from estuary to headwaters (Chapman and Chapman, 1982)
Extent of freshwater (lake) habitat	Hectares	No significant decline. Area mapped and calculated as 2.6ha	No field survey. Area mapped based on evidence that otters tend to forage within 80m of the shoreline (NPWS, 2007)
Couching sites and holts	Number	No significant decline	Otters need lying up areas throughout their territory where they are secure from disturbance (Kruuk, 2006; Kruuk and Moorhouse, 1991)
Fish biomass available	Kilograms	No significant decline	Broad diet that varies locally and seasonally, but dominated by fish, in particular salmonids, eels and sticklebacks in freshwater (Bailey and Rochford, 2006) and wrasse and rockling in coastal waters (Kingston et al., 1999)

1410 Mediterranean salt meadows (*Juncetalia maritimi*)

To restore the favourable conservation condition of Mediterranean salt meadows in the River Barrow and River Nore 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: Dunbrody Abbey - 0.08ha, Rochestown - 0.04ha, Ringville - 6.70ha. See map 5	Based on data from the Saltmarsh Monitoring Project (McCorry and Ryle, 2009). Three sub-sites were mapped and no additional areas of potential saltmarsh were identified from an examination of aerial photoraphs, giving a total estimated area of Mediterranean salt meadow of 6.82ha. NB further unsurveyed areas maybe present within the site. See coastal habitats supporting document for further details
Habitat distribution	Occurrence	No decline, subject to natural processes. See map 5	See coastal habitats supporting document for further details
Physical structure: sediment supply	Presence/absence of physical barriers	Maintain or where necessary restore natural circulation of sediments and organic matter, without any physical obstructions	See coastal habitats supporting document for further details
Physical structure: flooding regime	Hectares flooded; frequency	Maintain natural tidal regime	See coastal habitats supporting document for further details
Physical structure: creeks and pans	Occurrence	Maintain/restore creek and pan structure, subject to natural processes, including erosion and succession	Based on McCorry and Ryle (2009). See coastal habitats supporting document for further details
Vegetation structure: zonation	Occurrence	Maintain range of saltmarsh habitat zonations including transitional zones, subject to natural processes including erosion and succession. See map 5	Based on McCorry and Ryle (2009). See coastal habitats supporting document for further details
Vegetation structure: vegetation height	Centimetres	Maintain structural variation within sward	Based on McCorry and Ryle (2009). See coastal habitats supporting document for further details
Vegetation structure: vegetation cover	Percentage cover at a representative sample of monitoring stops	Maintain more than 90% of area outside creeks vegetated.	Based on McCorry and Ryle (2009). See coastal habitats supporting document for further details
Vegetation composition: typical species and sub-communities	Percentage cover at a representative sample of monitoring stops	Maintain range of sub-communities with typical species listed in Saltmarsh Monitoring Project (McCorry & Ryle, 2009)	See coastal habitats supporting document for further details
Vegetation structure: negative indicator species: *Spartina anglica*	Hectares	No significant expansion of *Spartina*. No new sites for this species and an annual spread of less than 1% where it is already known to occur	Based on McCorry and Ryle (2009). See coastal habitats supporting document for further details

1421 Killarney fern *Trichomanes speciosum*

To maintain the favourable conservation condition of Killarney Fern in the River Barrow and River Nore SAC, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Distribution	Location	No decline. Three locations known, with three colonies of gametophyte and one sporophyte colony. See map 7	Data from NPWS rare and threatened species database
Population size	Number	Maintain at least three colonies of gametophyte, and at least one sporophyte colony of over 35 fronds	Data from NPWS rare and threatened species database
Population structure: juvenile fronds	Occurrence	At least one of the locations to have a population structure comprising sporophyte, unfurling fronds, 'juvenile' sporophyte and gametophyte generations	'Juvenile' sporophytes, which appear as small entire fronds, are known from this site. However, it is unknown whether they are due to apogamous growth or sexual reproduction. Based on Kingston and Hayes (2005) and Ni Dhuill (pers. Comm.)
Habitat extent	m^2	No loss of suitable habitat, such as shaded rock crevices, caves or gullies in or near to, known colonies. No loss of woodland canopy at or near to known locations	Based on Kingston and Hayes (2005) and Ni Dhuill (pers. Comm.)
Hydrological conditions: visible water	Occurrence	Maintain hydrological conditions at the locations so that all colonies are in dripping or damp seeping habitats, and water is visible at all locations	Based on Kingston and Hayes (2005) and Ni Dhuill (pers. Comm.)
Hydrological conditions: humidity	Number of dessicated fronds	No increase. Presence of dessicated sporophyte fronds or gametophyte mats indicates conditions are unsuitable	Based on Kingston and Hayes (2005) and Ni Dhuill (pers. Comm.)
Light levels: shading	Percentage	No changes due to anthropogenic impacts	Based on Kingston and Hayes (2005) and Ni Dhuill (pers. Comm.)
Invasive species	Occurrence	Absent or under control	NPWS and EHS-NI (2008) provides further details

1990 Nore freshwater pearl mussel *Margaritifera durrovensis*

To restore the favourable conservation condition of the Nore freshwater pearl mussel in the River Barrow and River Nore SAC, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Distribution	Kilometres	Maintain at 15.5km. See map 7	The population stretches from Poorman's Bridge (S407859) to Lismaine Bridge (S442660), with most of the population found between Poorman's Bridge and the Avonmore Creamery above Ballyragget (S 440 722) (Moorkens, 1996)
Population size: adult mussels	Number	Restore to 5,000 adult mussels	The extant wild population of Nore freshwater pearl mussel is estimated as 300 adult individuals (Moorkens, 2009)
Population structure: recruitment	Percentage per size class	Restore to at least 20% of population no more than 65mm in length; and at least 5% of population no more than 30mm in length	Mussels of no more than 65mm are considered 'young mussels' and may be found buried in the substratum and/or beneath adult mussels. Mussels of no more than 30mm are 'juvenile mussels' and are always buried in the substratum. This species is known not to have reproduced successfully in the River Nore since 1970 (Moorkens and Costello, 1994; Moorkens, 2004; Government of Ireland, 2009 [S.I. 272 of 2009])
Population structure: adult mortality	Percentage	No more than 5% decline from previous number of live adults counted; dead shells less than 1% of the adult population and scattered in distribution	5% is considered the cut-off between the combined errors associated with natural fluctuations and sampling methods and evidence of true population decline. 1% of dead shells is considered to be indicative of natural losses
Habitat extent	Kilometres	Restore suitable habitat in length of river corresponding to distribution target (15.5km; see map 7) and any additional stretches necessary for salmonid spawning	The species habitat is a stretch of large lowland 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 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

1990 Nore freshwater pearl mussel *Margaritifera durrovensis*

To restore the favourable conservation condition of the Nore freshwater pearl mussel in the River Barrow and River Nore SAC, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Water quality: Macroinvertebrates and phytobenthos (diatoms)	Ecological quality ratio (EQR)	Restore water quality-macroinvertebrates: EQR greater than 0.90; phytobenthos: EQR greater than 0.93	These EQRs correspond to high ecological status for these two Water Framework Directive biological quality elements. They represent high water quality with very low nutrient concentrations (oligotrophic conditions). The habitat of the Nore pearl mussel failed both standards during 2009 sampling for the Sub-basin Management Plan (DEHLG, 2010). See also The European Communities Environmental Objectives (Surface Water Objectives) Regulations 2009
Substratum quality: Filamentous algae (macroalgae), macrophytes (rooted higher plants)	Percentage	Restore substratum quality-filamentous algae: absent or trace (<5%); macrophytes: absent or trace (<5%)	High abundance of macroalgae was recorded during 2009 sampling for the Sub-basin Management Plan (DEHLG, 2010). Recruitment of juvenile mussels is being prevented by the poor quality of the river substrate
Substratum quality: sediment	Occurrence	Restore substratum quality-stable cobble and gravel substrate with very little fine material; no artificially elevated levels of fine sediment	The habitat for the species is currently unsuitable for the survival of adult mussels or the recruitment of juveniles owing to sedimentation of the substratum. Significant sedimentation has been recorded during all recent mussel monitoring surveys. Recruitment of juvenile mussels is being prevented by the poor quality of the river substrate
Substratum quality: oxygen availability	Redox potential	Restore to no more than 20% decline from water column to 5cm depth in substrate	Differences in redox potential between the water column and the substrate correlate with differences in oxygen levels. Juvenile mussels require full oxygenation while buried in gravel. In suitable habitat, there should be very little loss of redox potential between the water column and underlying gravels. The redox potential loss in 2009 was 58-64% at 5cm depth (DEHLG, 2010)
Hydrological regime: flow variability	Metres per second	Restore appropriate hydrological regimes	The availability of suitable Nore freshwater pearl mussel habitat is largely determined by flow (catchment geology being the other important factor). In order to restore the habitat for the species, flow variability over the annual cycle must be such that: 1) high flows can wash fine sediments from the substratum, 2) low flows do not exacerbate the deposition of fines and 3) low flows do not cause stress to mussels in terms of exposure, water temperatures, food availability or aspects of the reproductive cycle

1990 Nore freshwater pearl mussel *Margaritifera durrovensis*

To restore the favourable conservation condition of the Nore freshwater pearl mussel in the River Barrow and River Nore SAC, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Host fish	Number	Maintain sufficient juvenile salmonids to host glochidial larvae	Salmonid fish are host to the larval form of freshwater pearl mussels and thus, they are essential to the completion of the life cycle. 0+ and 1+ fish are typically used, both because of the habitat overlaps and the development of immunity with age in the fish. Fish presence is considered sufficient, as higher densities and biomass of fish is indicative of enriched conditions in mussel rivers. Geist et al. (2006) found that higher densities of host fish coincided with eutrophication, poor substrate quality for pearl mussels and a lack of pearl mussel recruitment, while significantly lower densities and biomass of host fish were associated with high numbers of juvenile mussels. Fish movement patterns must be such that 0+ fish in the vicinity of the mussel habitat remain in the mussel habitat until their 1+ summer. As native brown trout appear to be favoured by the Nore freshwater pearl mussel, it is particularly important that these are not out-competed by stocked fish

3260 Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation

To maintain the favourable conservation condition of Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation in the River Barrow and River Nore SAC, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Habitat distribution	Occurrence	No decline, subject to natural processes	The full distribution of this habitat and its sub-types in this site is currently unknown. The basis of the selection of the SAC for the habitat is the presence of an excellent example of the vegetation community (nutrient-rich type) associated with extensive tufa deposits on the river bed in the Kings tributary of the Nore (Heuff, 1987). Other examples of this or other sub-types may be present within the SAC
Habitat area	Kilometres	Area stable or increasing, subject to natural processes	The full extent of this habitat in this site is currently unknown. See above
Hydrological regime: river flow	Metres per second	Maintain appropriate hydrological regimes	Due to regular disturbance (through variations in flow), river macrophytes rarely reach a climax condition but frequently occur as transient communities. A natural (relatively unmodified) flow regime is required for both plant communities and channel geomorphology to be in favourable condition, exhibiting typical dynamics for the river type (Hatton-Ellis and Grieve, 2003). For most of the sub-types of this habitat, high flows are required to maintain the substratum (see below) necessary for the characteristic species. Flow variation is particularly important, with high and flood flows being critical to the hydromorphology
Hydrological regime: groundwater discharge	Metres per second	The groundwater flow to the habitat should be permanent and sufficient to maintain tufa formation	This attribute refers to sub-types with tufa formations. Groundwater discharges to this habitat throughout the year
Substratum composition: particle size range	Millimetres	The substratum should be dominated by large particles and free from fine sediments	The tufaceous sub-types develop on relatively stable substrata such as bedrock, boulders and cobbles, where tufa can deposit and accumulate. Tufa deposition is believed to be biologically mediated, by algae and bryophytes. The substratum must remain free of fine sediments such as clay, silt and fine sand, which would adversely affect the growth of algae and mosses

3260 Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation

To maintain the favourable conservation condition of Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation in the River Barrow and River Nore SAC, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Water chemistry: minerals	Milligrammes per litre	The groundwater and surface water should have sufficient concentrations of minerals to allow deposition and persistence of tufa deposits	The tufaceous sub-types require mineral-(typically calcium-) rich groundwaters to allow deposition of tufa. Surface water must also be sufficiently base-rich to prevent chemical erosion. Alkalinity and/or total hardness data may also be relevant
Water quality: suspended sediment	Milligrammes per litre	The concentration of suspended solids in the water column should be sufficiently low to prevent excessive deposition of fine sediments	See substratum composition above. Turbidity data may also be relevant
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	Phosphorus (MRP) is typically the limiting nutrient, however increased nitrogen (NO3-) negatively impacts upon the N-fixing blue-green algal communities that frequently contribute to tufa deposition. Nutrient enrichment of the habitat typically leads to increased filamentous-green-algal biomass, and consequent changes in other algae, bryophyte and macrophyte species composition and abundance. Water quality should reach a minimum of Water Framework Directive good status, in terms of nutrient standards, and macroinvertebrate and phytobenthos quality elements
Vegetation composition: typical species	Occurrence	Typical species of the relevant habitat sub-type should be present and in good condition	The sub-types of this habitat are poorly understood and their typical species have not yet been defined. Typical species and appropriate targets may emerge to be site-specific. The typical species of the tufaceous sub-type in the Kings tributary of the Nore are identified in Heuff (1987). The typical species may include higher plants, bryophytes, macroalgae and microalgae
Floodplain connectivity	Area	The area of active floodplain at and upstream of the habitat should be maintained	River connectivity with the floodplain is essential for the functioning of this habitat. The site of the tufaceous sub-type in the King's River is within an area of floodplain, with further large floodplains upstream. Floodplains regulatefine sediment deposition within the channel. See substratum composition above

4030 European dry heaths

To maintain the favourable conservation condition of European dry heaths in the River Barrow and River Nore SAC, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Habitat distribution	Occurrence	No decline from current habitat distribution, subject to natural processes	Spatial extent currently unmapped but indicated as occurring on the steep, free-draining, river valley sides especially the Barrow and tributaries in the foothills of the Blackstairs Mountains (based on NPWS NHA Survey - 1997/98 Site Notes; Natura 2000 Form Explanatory Notes - May 2006; The above NHA survey was prior to the extensions to the SAC that included river habitat and estuary at Ballyhack which may have incorporated additional dry heath habitat)
Habitat area	Hectares	Area stable or increasing, subject to natural processes. Habitat area is not known but estimated as less than 400ha of the area of the SAC, occurring in dispersed locations	Based on NPWS NHA Survey Site Notes (1997/98); Natura 2000 Form Explanatory Notes - May 2006
Physical structure: free-draining, acid, low nutrient soil; rock outcrops	Occurrence	No significant change in soil nutrient status, subject to natural processes. No increase or decrease in area of natural rock outcrop	Based on NPWS NHA Survey Site Notes - 1997/98; Natura 2000 Form Explanatory Notes - May 2006
Vegetation structure: sub-shrub indicator species	Percentage cover	Cover of characteristic sub-shrub indicator species at least 25%: gorse (*Ulex europaeus*) and where rocky outcrops occur bilberry (*Vaccinium myrtillus)* and woodrush (*Luzula sylvatica*). Some rock outcrops support English stonecrop (*Sedum anglicum*), sheep's bit (*Jasione montana*) and wild madder (*Rubia peregrina*) as well as important moss and lichen assemblages	Dry heath in this SAC occurs on free-draining nutrient poor soils and is often characterised by gorse and open acid grassland areas. A characteristic coastal dry heath of the southeast also occurs. Several rare plants occur including two species listed in the Red Data Book (Curtis and McGough, 1988). The species occurring on the site are listed in NPWS NHA Survey Site Notes - 1997/98. A brief overview of the principal characteristics of the dry heath habitat of this SAC is given in the Natura 2000 Explanatory Notes - May 2006
Vegetation structure: senescent gorse	Percentage cover	Cover of senescent gorse less than 50%	Based on NPWS NHA Survey Site Notes and Natura 2000 Form Explanatory Notes - May 2006 and on a modified version of the dry heath condition assessment methodology of Perrin et al. (2010)
Vegetation structure: browsing	Percentage cover	Long shoots of bilberry with signs of browsing collectively less than 33%	Based on NPWS NHA Survey Site Notes and Natura 2000 Form Explanatory Notes - May 2006 and on a modified version of the dry heath condition assessment methodology of Perrin et al. (2010)

4030 European dry heaths

To maintain the favourable conservation condition of European dry heaths in the River Barrow and River Nore SAC, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Vegetation structure: native trees and shrubs	Percentage cover	Cover of scattered native trees and shrub less than 20%	Based on NPWS NHA Survey Site Notes - 1997/98; Natura 2000 Form Explanatory Notes - May 2006 and on a modified version of the dry heath habitat condition assessment methodology of Perrin et al. (2010). From the NHA survey notes the main threats appear to be reclamation or invasion by scrub woodland
Vegetation composition: positive indicator species	Number	Number of positive indicator species at least 2 e.g. gorse and associated dry heath/ acid grassland flora	Dry heath in this SAC occurs on free-draining nutrient poor soils and is characterised by gorse and acid grassland areas. It corresponds to Annex I sub-type "heaths rich in gorse (*Ulex*) of the Atlantic margins" (European Commission, 2007). Based on NPWS NHA Survey Site Notes -1997/98; Natura 2000 Form Explanatory Notes - May 2006 and a modified version of the dry heath habitat condition assessment methodology of Perrin et al. (2010)
Vegetation structure: positive indicator species	Percentage cover	Cover of positive indicator species at least 60%. This should include plant species characterisitic of dry heath in this SAC including gorse, bilberry and associated acid grassland flora	Dry heath in this SAC is characterised by gorse and acid grassland areas and locally bilberry and woodrush. Based on NPWS NHA Survey Site Notes and Natura 2000 Form Explanatory Notes - May 2006 and a modified version of the dry heath habitat condition assessment methodology of Perrin et al. (2010)
Vegetation composition: bryophyte and non-crustose lichen species	Number	Number of bryophyte or non-crustose lichen species present at least 2	Based on NPWS NHA Survey Site Notes and Natura 2000 Form Explanatory Notes - May 2006 and on a modified version of the dry heath habitat condition assessment methodology of Perrin et al. 2010
Vegetation composition: bracken (*Pteridium aquilinum*)	Percentage cover	Cover of bracken less than 10% - however see 'Notes'	Based on NPWS NHA Survey Site Notes and Natura 2000 Form Explanatory Notes - May 2006 and on a modified version of the dry heath habitat condition assessment methodology of Perrin et al. (2010). Bracken appears to be quite dense in places and before any management action is considered its rate of spread needs to be established as well as its threat, if any, to other dry heath species and its potential value to important fauna (e.g. Twite)

4030 European dry heaths

To maintain the favourable conservation condition of European dry heaths in the River Barrow and River Nore SAC, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Vegetation structure: weedy negative indicator species	Percentage cover	Cover of agricultural weed species (negative indicator species) less than 1%	Based on NPWS NHA Survey Site Notes and Natura 2000 Form Explanatory Notes - May 2006 and on a modified version of the dry heath habitat condition assessment methodology of Perrin et al. (2010)
Vegetation composition: non-native species	Percentage cover	Cover of non-native species less than 1%.	Based on NPWS NHA Survey Site Notes and Natura 2000 Form Explanatory Notes - May 2006 and on a modified version of the dry heath habitat condition assessment methodology of Perrin et al. (2010)
Vegetation composition: rare/scarce heath species	Location, area and number	No decline in distribution or population sizes of rare, threatened or scarce species, including Greater Broomrape (*Orobanche rapum-genistae)* and the legally protected clustered clover (*Trifolium glomeratum*)	Broomrape is dependent on gorse at this site as it is parasitic on gorse roots. It is recorded as occurring on steep slopes above New Ross. A small area of excellent dry coastal heath at Ballyhack is interspersed with patches rock and of dry lowland grassland and has a high species diversity. Notably there is an excellent range of Clover (*Trifolium*) species including the legally protected clustered clover, a species known only from one other site in Ireland. Also *T. ornithopodiodes*, *T. striatum* and *Torilus nodosa*. Based on Natura 2000 Form Explanatory Notes May 2006, Irish Red Data Book (Curtis and Mc Gough, 1988) and on the NPWS database of rare and threatened vascular plants. Other areas of coastal heath may also occur
Vegetation structure: disturbed bare ground	Percentage cover	Cover of disturbed bare ground less than 10% (but if peat soil less than 5%)	Based on NPWS NHA Survey Site Notes and Natura 2000 Form Explanatory Notes - May 2006 and on a modified verison of the dry heath habitat condition assessment methodology of Perrin et al. (2010)
Vegetation structure: burning	Occurrence	No signs of burning within sensitive areas	Perrin et al. (2010) defines sensitive areas

6430 Hydrophilous tall herb fringe communities of plains and of the montane to alpine levels

To maintain the favourable conservation condition of Hydrophilous tall herb fringe communities of plains and of the montane to alpine levels in the River Barrow and River Nore SAC, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Habitat distribution	Occurrence	No decline, subject to natural processes	Distribution of this habitat in this site is currently unknown. Considered to occur in association with some riverside woodlands, unmanaged river islands and in narrow bands along the floodplain of slow-flowing stretches of river (Natura 2000 Form Explanatory Notes)
Habitat area	Hectares	Area stable or increasing, subject to natural processes	Extent of this habitat in this site is currently unknown. See above
Hydrological regime: Flooding depth/height of water table	Metres	Maintain appropriate hydrological regimes	This habitat requires winter inundation, which results in deposition of naturally nutrient-rich sediment
Vegetation structure:sward height	Centimetres	30-70% of sward is between 40 and 150cm in height	Bare ground, due to natural indundation processes, may often be present. Attribute and target based on the Irish Semi-natural Grassland Survey (O'Neill et al., 2010)
Vegetation composition: broadleaf herb: grass ratio	Percentage	Broadleaf herb component of vegetation between 40 and 90%	Attribute and target based on O'Neill et al. (2010)
Vegetation composition: typical species	Number	At least 5 positive indicator species present	List of positive indicator species identified by O'Neill et al. (2010)
Vegetation composition: negative indicator species	Occurrence	Negative indicator species, particularly non-native invasive species, absent or under control- NB Indian balsam (*Impatiens glandulifera*), monkeyflower (*Mimulus guttatus*), Japanese knotweed (*Fallopia japonica*) and giant hogweed (*Heracleum mantegazzianum*)	Species listed as being present in the site (Natura 2000 Form Explanatory Notes)

7220 * Petrifying springs with tufa formation (*Cratoneurion*)

To maintain the favourable conservation condition of Petrifying springs with tufa formation (*Cratoneurion*) in the River Barrow and River Nore SAC, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Habitat area	Square metres	Area stable or increasing, subject to natural processes	Extent of this habitat in this site is currently unknown. An area ("Tens of square metres") has been described at one location (Natura 2000 Form Explanatory Notes; internal NPWS files), see below
Habitat distribution	Occurrence	No decline. See map 6 for recorded location	Full distribution of this habitat in this site is currently unknown. It has been described in woodlands at Dysart, between Thomastown and Inistioge (Natura 2000 Form Explanatory Notes; internal NPWS files). NB futher areas are likely to occur within the site
Hydrological regime: height of water table; water flow	Metres; metres per second	Maintain appropriate hydrological regimes	Current hydrological regimes are unknown. Petrifying springs rely on permanent irrigation, usually from upwelling groundwater sources or seepage sources
Water quality	Water chemistry measures	Maintain oligotrophic and calcareous conditions	Water chemistry is currently unknown. Water supply to petrifying springs is characteristically oligotrophic and calcareous
Vegetation composition: typical species	Occurrence	Maintain typical species	The bryophytes *Cratoneuron commutatum* and *Eucladium verticillatum* are diagnostic of this habitat. Both are found at the location described above. Natura 2000 Form Explanatory Notes and internal NPWS files also list other typical species

91A0 Old sessile oak woods with *Ilex* and *Blechnum* in the British Isles

To restore the favourable conservation condition of Old oak woodland with Ilex and Blechnum in the River Barrow and River Nore 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, at least 85.08ha for sub-sites surveyed: see map 6	Minimum area, based on 13 sites surveyed by Perrin et al. (2008) - site codes 14, 20, 49, 73, 125, 508, 509, 510, 514, 515, 518, 519, 521, and other sources. NB further unsurveyed areas maybe present within the site
Habitat distribution	Occurrence	No decline. Surveyed locations shown on map 6	Distribution based on Perrin et al. (2008). NB further unsurveyed areas maybe present within the site
Woodland size	Hectares	Area stable of increasing. Where topographically possible, "large" woods at least 25ha in size and “small” woods at least 3ha in size	The sizes of at least some of the existing woodlands need to be increased in order to reduce habitat fragmentation and benefit those species requiring ‘deep’ woodland conditions (Peterken, 2002). Topographical and land ownership constraints may restrict expansion
Woodland structure: cover and height	Percentage and metres	Diverse structure with a relatively closed canopy containing mature trees; subcanopy layer with semi-mature trees and shrubs; and well-developed herb layer	Described in Perrin et al. (2008); Browne et al. (2000). See woodland habitats supporting document for further details
Woodland structure: community diversity and extent	Hectares	Maintain diversity and extent of community types	Described in Perrin et al. (2008); Browne et al. (2000). See woodland habitats supporting document for further details
Woodland structure: natural regeneration	Seedling:sapling:pole ratio	Seedlings, saplings and pole age-classes occur in adequate proportions to ensure survival of woodland canopy	Oak regenerates poorly. In suitable sites ash can regenerate in large numbers although few seedlings reach pole size
Woodland structure: dead wood	m^3 per hectare; number per hectare	At least 30m^3/ha of fallen timber greater than 10cm diameter; 30 snags/ha; both categories should include stems greater than 40cm diameter	Dead wood is a valuable resource and an integral part of a healthy, functioning woodland ecosystem.
Woodland structure: veteran trees	Number per hectare	No decline	Mature and veteran trees are important habitats for bryophytes, lichens, saproxylic organisms and some bird species. Their retention is important to ensure continuity of habitats/niches and propagule sources

91A0 Old sessile oak woods with *Ilex* and *Blechnum* in the British Isles

To restore the favourable conservation condition of Old oak woodland with Ilex and Blechnum in the River Barrow and River Nore SAC, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Woodland structure: indicators of local disctinctiveness	Occurrence	No decline	Includes ancient or long-established woodlands, archaeological and geological features as well as red-listed and other rare or localised species. Perrin and Daly (2010) list sites 14, 20, 73, 125, 508, 509, 510, 514, 515, 518, 521 as potential ancient/long established woodlands
Vegetation composition: native tree cover	Percentage	No decline. Native tree cover not less than 95%	Species reported in Perrin et al. (2008); Browne et al. (2000)
Vegetation composition: typical species	Occurrence	A variety of typical native species present, depending on woodland type, including oak (*Quercus petraea*) and birch (*Betula pubescens*)	Species reported in Perrin et al. (2008); Browne et al. (2000)
Vegetation composition: negative indicator species	Occurrence	Negative indicator species, particularly non-native invasive species, absent or under control	The following are the most common invasive species in this woodland type: beech (*Fagus sylvatica*), rhododendron (*Rhododendron ponticum*), cherry laurel (*Prunus laurocerasus*)

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

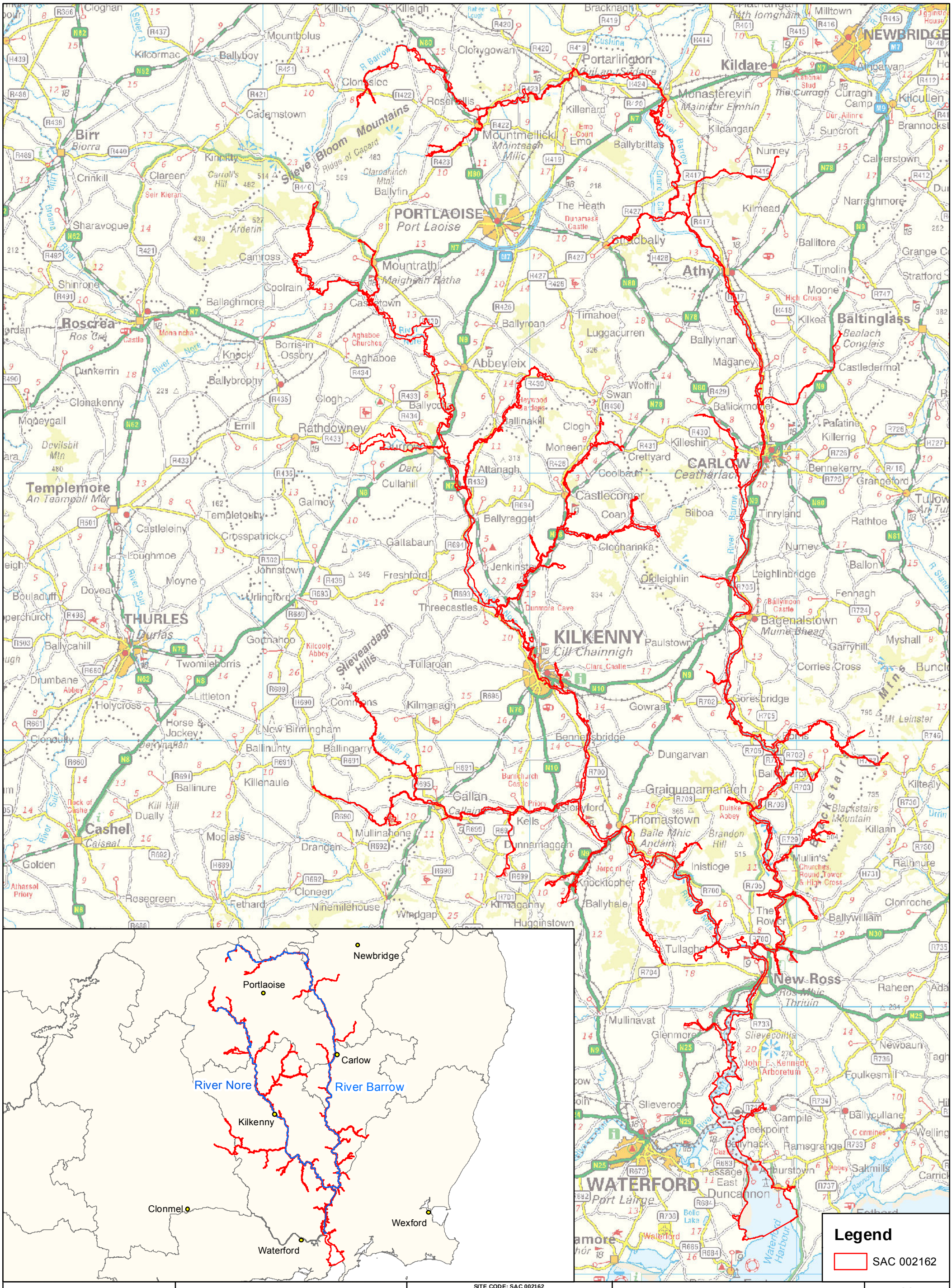
To restore the favourable conservation condition of Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (*Alno-Padion*, *Alnion incanae*, *Salicion albae*) in the River Barrow and River Nore SAC, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Habitat area	Hectares	Area stable or increasing, subject to natural processes, at least 181.54ha for sites surveyed: see map 6	Minimum area, based on 16 sites surveyed by Perrin et al. (2008) - site codes 10, 15, 17, 126, 127, 262, 282, 287, 511, 516, 517, 518, 520, 608, 1021; Coillte LIFE project and other sources. NB further unsurveyed areas maybe present within the SAC
Habitat distribution	Occurrence	No decline. Surveyed locations shown on map 6	Distribution based on Perrin et al. (2008). NB further unsurveyed areas maybe present within the site
Woodland size	Hectares	Area stable of increasing. Where topographically possible, "large" woods at least 25ha in size and “small” woods at least 3ha in size	The sizes of at least some of the existing woodlands need to be increased in order to reduce habitat fragmentation and benefit those species requiring ‘deep’ woodland conditions (Peterken, 2002). Topographical and land ownership constraints may restrict expansion
Woodland structure: cover and height	Percentage and metres	Diverse structure with a relatively closed canopy containing mature trees; subcanopy layer with semi-mature trees and shrubs; and well-developed herb layer	Described in Perrin et al. (2008); Browne et al. (2000). See woodland habitats supporting document for further details
Woodland structure: community diversity and extent	Hectares	Maintain diversity and extent of community types	Described in Perrin et al. (2008); Browne et al. (2000). See woodland habitats supporting document for further details
Woodland structure: natural regeneration	Seedling:sapling:pole ratio	Seedlings, saplings and pole age-classes occur in adequate proportions to ensure survival of woodland canopy	Alder and oak regenerate poorly. Ash often regenerates in large numbers although few seedlings reach pole size
Hydrological regime: Flooding depth/height of water table	Metres	Appropriate hydrological regime necessary for maintenance of alluvial vegetation	Periodic flooding is essential to maintain alluvial woodlands along river flood plains but not for woodland around springs/seepage areas
Woodland structure: dead wood	m^3 per hectare; number per hectare	At least $30m^3$/ha of fallen timber greater than 10cm diameter; 30 snags/ha; both categories should include stems greater than 40cm diameter (greater than 20cm diameter in the case of alder)	Dead wood is a valuable resource and an integral part of a healthy, functioning woodland ecosystem

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

To restore the favourable conservation condition of Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (*Alno-Padion*, *Alnion incanae*, *Salicion albae*) in the River Barrow and River Nore SAC, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Woodland structure: veteran trees	Number per hectare	No decline	Mature and veteran trees are important habitats for bryophytes, lichens, saproxylic organisms and some bird species. Their retention is important to ensure continuity of habitats/niches and propagule sources
Woodland structure: indicators of local disctinctiveness	Occurrence	No decline	Includes ancient or long-established woodlands, archaeological and geological features as well as red-listed and other rare or localised species. Perrin and Daly (2010) list sites 10, 15, 17, 127, 282, 516, 517, 518, 608 as potential ancient/long established woodlands
Vegetation composition: native tree cover	Percentage	No decline. Native tree cover not less than 95%	Species reported in Perrin et al. (2008); Browne et al. (2000)
Vegetation composition: typical species	Occurrence	A variety of typical native species present, depending on woodland type, including ash (*Fraxinus excelsior*) alder (*Alnus glutinosa*), willows (*Salix* spp) and locally, oak (*Quercus robur*)	Species reported in Perrin et al. (2008); Browne et al. (2000)
Vegetation composition: negative indicator species	Occurrence	Negative indicator species, particularly non-native invasive species, absent or under control	The following are the most common invasive species in this woodland type: sycamore (*Acer pseudoplatanus*), beech (*Fagus sylvatica*), rhododendron (*Rhododendron ponticum*), cherry laurel (*Prunus laurocerasus*), dogwood (*Cornus sericea*), Himalayan honeysuckle (*Leycesteria formosa*) and Himalayan balsam (*Impatiens grandiflora*)



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MAP 1: RIVER BARROW AND RIVER NORE CONSERVATION OBJECTIVES SAC DESIGNATION

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

SITE CODE: SAC 002162
CO. CARLOW; version 1.03, CO. KILDARE; version 1.04, CO. KILKENNY; version 1.1, CO. LAOIS; version 1.07, CO. OFFALY; version 1.01, CO. TIPPERARY; version 1.01, CO. WATERFORD; version 1.01, CO. WEXFORD; version 1.01

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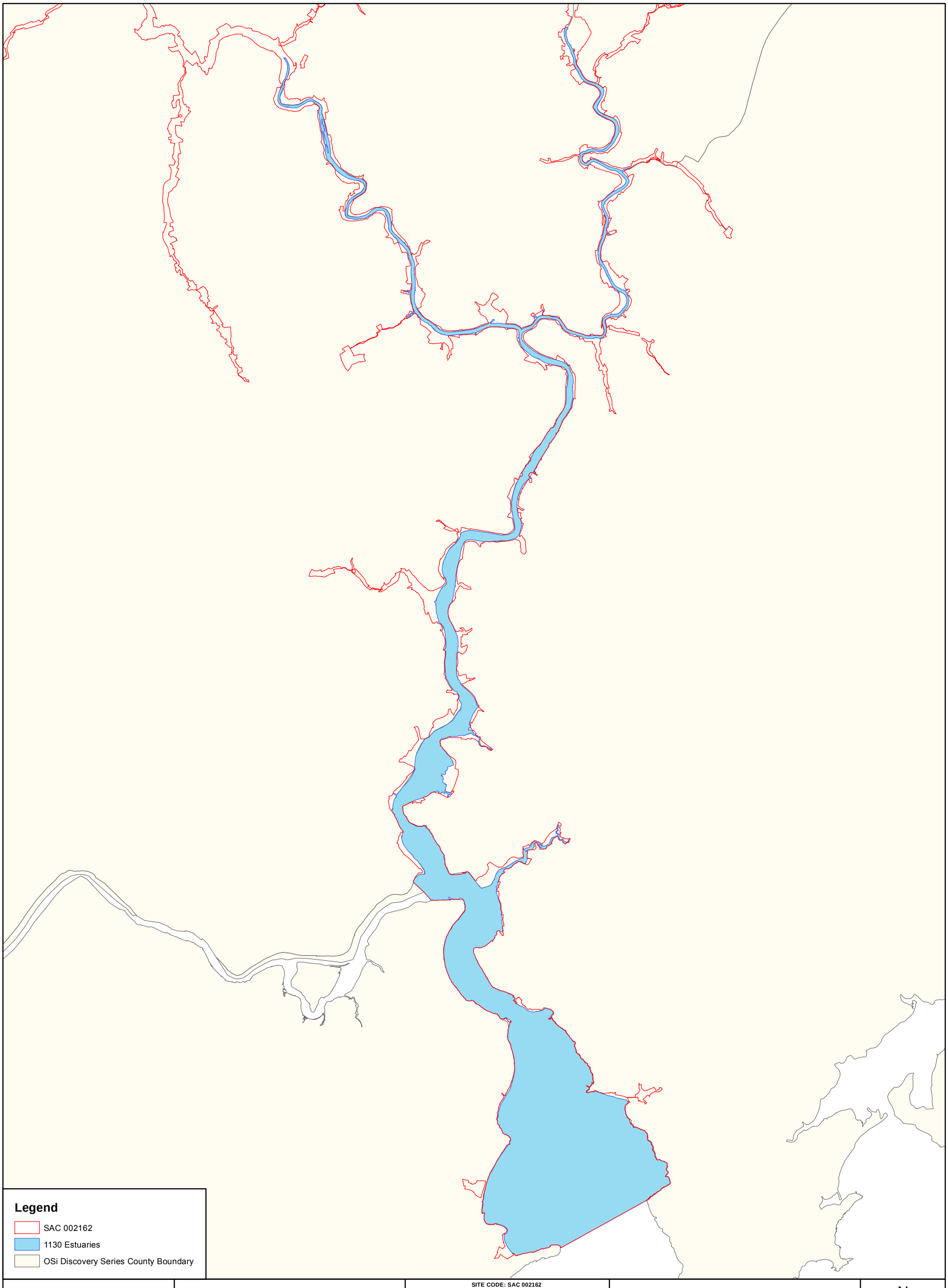
N

Map Version 1
Date: April 2011



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MAP 2:
RIVER BARROW AND RIVER NORE CONSERVATION OBJECTIVES ESTUARIES

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

SITE CODE: SAC 002162
CO. CARLOW; version 1.03, CO. KILDARE; version 1.04,
CO. KILKENNY; version 1.1, CO. LAOIS; version 1.07,
CO. OFFALY; version 1.01, CO. TIPPERARY; version 1.01,
CO. WATERFORD; version 1.01, CO. WEXFORD; version 1.01

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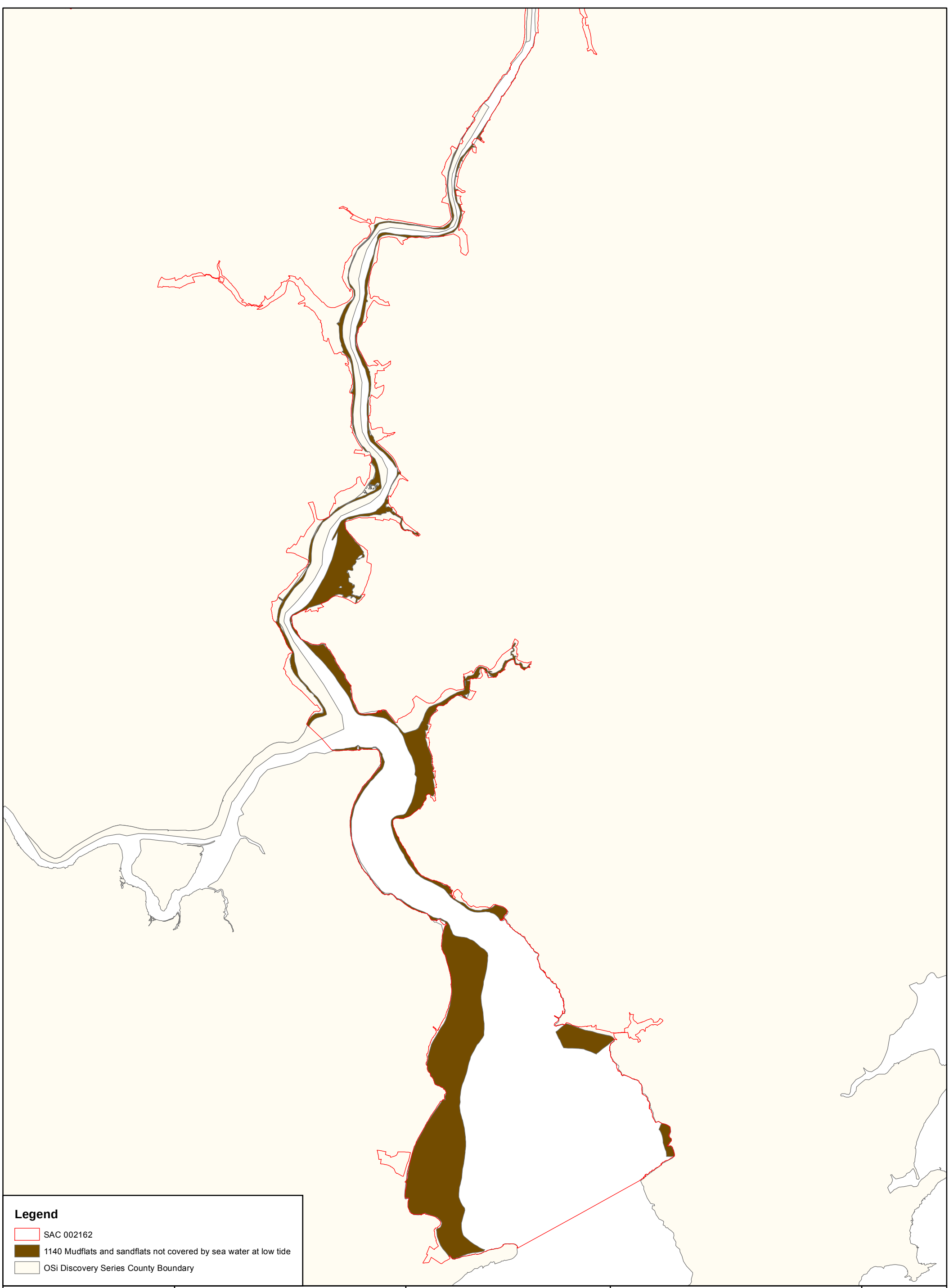
N

Map Version 1
Date: April 2011



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MAP 3:
RIVER BARROW AND RIVER NORE CONSERVATION OBJECTIVES TIDAL MUDFLATS AND SANDFLATS

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

SITE CODE: SAC 002162
CO. CARLOW; version 1.03, CO. KILDARE; version 1.04, CO. KILKENNY; version 1.1, CO. LAOIS; version 1.07, CO. OFFALY; version 1.01, CO. TIPPERARY; version 1.01, CO. WATERFORD; version 1.01, CO. WEXFORD; version 1.01

0 1 2 3 km

N

Map Version 1
Date: April 2011

Legend

- SAC 002162
- OSi Discovery Series County Boundary

Community Types

- Fine sand with *Fabulina fabula* community
- Muddy estuarine community complex
- Sand to Muddy fine sand community complex
- *Sabellaria alveolata* reef

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MAP 4:
RIVER BARROW AND RIVER NORE CONSERVATION OBJECTIVES MARINE COMMUNITY TYPES

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

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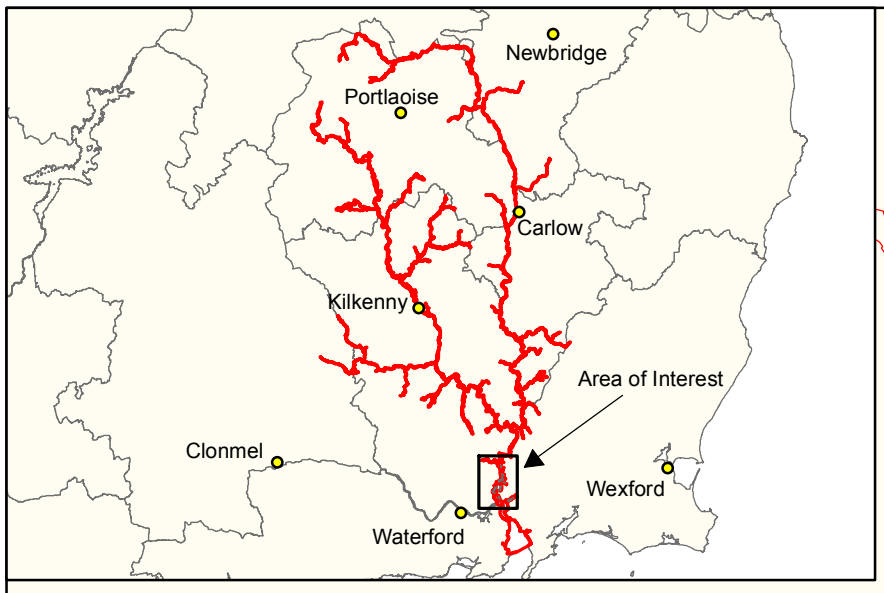
0 1 2 3 km

N

Map Version 1
Date: April 2011



SMP0049

SMP0050

SMP0051

SMP0048

Legend

- SAC 002162
- OSi Discovery Series County Boundary

Saltmarsh Habitats

- 1310 *Salicornia* and other annuals colonising mud and sand
- 1330 Atlantic salt meadows (Glauco-Puccinellietalia maritimae)
- 1330 / 1410 Atlantic salt meadows (Glauco-Puccinellietalia maritimae) / Mediterranean salt meadows (Juncetalia maritimi)
- 1410 Mediterranean salt meadows (Juncetalia maritimi)
- Potential 1330 Atlantic salt meadows (Glauco-Puccinellietalia maritimae)

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MAP 5:
RIVER BARROW AND RIVER NORE CONSERVATION OBJECTIVES SALTMARSH HABITATS

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

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0 0.25 0.5 0.75 1 km

N

Map Version 1
Date: April 2011

Newbridge

262

Portlaoise

1021

608

287

282

Carlow

10

Kilkenny

127

15

17

49

73

14

516

517

126

518

519

520

515

125

521

20

514

510

508

509

511

Legend

- SAC 002162
- OSi Discovery Series County Boundary
- 7220 *Petrifying springs with tufa formation (Cratoneurion)

Woodland Habitats

- 91A0 Old sessile oak woods with *Ilex* and *Blechnum* in the British Isles
- 91E0 *Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (Alno-padion, Alnion incanae, Salicion albae)
- 91A0 / 91E0 Old sessile oak woods with *Ilex* and *Blechnum* in the British Isles / *Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (Alno-padion, Alnion incanae, Salicion albae)
- WD1 (Mixed) broadleaved woodland
- WN2 / WD1 Oak-ash-hazel woodland / (Mixed) broadleaved woodland
- WN2 / WN6 Oak-ash-hazel woodland / Wet willow-alder-ash woodland

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MAP 6:
RIVER BARROW AND RIVER NORE CONSERVATION OBJECTIVES OLD OAK WOODLANDS, ALLUVIAL FORESTS & PETRIFYING SPRINGS

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

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0 2 4 6 8 10 km

N

Map Version 1
Date: April 2011

Legend

- SAC 002162
- OSi Discovery Series County Boundary
- 1016 Desmoulin's Whorl Snail - *Vertigo moulinsiana*
- 1092 White-Clawed Crayfish - *Austropotamobius pallipes*
- 1421 Killarney Fern - *Trichomanes speciosum*
- 1990 Nore Freshwater Pearl Mussel - *Margaritifera durrovensis*

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MAP 7:
RIVER BARROW AND RIVER NORE CONSERVATION OBJECTIVES DESMOULIN'S WHORL SNAIL, WHITE-CLAWED CRAYFISH, NORE FRESHWATER PEARL MUSSEL & KILLARNEY FERN

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

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0 2 4 6 8 10 km

N

Map Version 1
Date: April 2011

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Ealaíon, Oidhreachta agus Gaeltachta
Department of
Arts, Heritage and the Gaeltacht

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