

**ENNISCORTHY FLOOD DEFENCE SCHEME:  
MACROPHYTE SURVEY**

**July 2017**

**Report produced by Denyer Ecology for:  
Scott Cawley Ltd**

**Report information**

<b>Report title:</b>	Enniscorthy Flood Defence Scheme: Macrophyte survey	
<b>Client:</b>	Scott Cawley Ltd	
<b>Document reference:</b>	DE2026 R06a	
<b>Project number:</b>	DE2026	
<b>Author(s):</b>	Dr Joanne Denyer	<b>Date:</b> July 2017
<b>Checked and authorised:</b>		<b>Date:</b>

## CONTENTS

<b>1</b>	<b>INTRODUCTION .....</b>	<b>4</b>
1.1	Background.....	4
1.2	Aims.....	4
1.3	Statement of authority.....	4
<b>2</b>	<b>METHODOLOGY.....</b>	<b>5</b>
2.1	Study area.....	5
2.2	Definition of Annex I priority habitat 3260 Floating River Vegetation .....	5
2.2.1	Interpretation manual of European Union habitats (EC, 2007) .....	6
2.2.2	Article 17 report 2013 (NPWS, 2013).....	6
2.2.3	Review of Floating River Vegetation in Ireland (Kelleher, 2011) .....	6
2.2.4	River Slaney SAC Conservation Objectives (NPWS, 2011).....	7
2.2.5	Site Synopsis: Slaney River Valley SAC (NPWS, 2014) .....	7
2.2.6	JNCC Background to 3260 SAC Site selection.....	7
2.3	Classification of Floating River Vegetation.....	7
2.3.1	Classification of 3260 vegetation communities in Ireland .....	7
2.3.2	Classification of 3260 vegetation communities in the United Kingdom .....	8
2.4	Condition assessment .....	8
2.5	Desktop data .....	9
2.5.1	Floating river vegetation .....	9
2.5.2	<i>Callitriche truncata</i> and <i>Groenlandia densa</i> .....	10
2.6	Field survey.....	11
2.6.1	General aquatic survey of FDS potential zone of influence .....	11
2.6.2	<i>Callitriche truncata</i> survey .....	13
2.7	Licence.....	15
2.8	Microscope identification, voucher specimens and referees .....	15
2.9	Ecological evaluation.....	<b>Error! Bookmark not defined.</b>
2.10	Plant species nomenclature .....	15
2.11	Limitations.....	15
<b>3</b>	<b>RESULTS AND EVALUATION.....</b>	<b>16</b>
3.1	Aquatic macrophyte transects and general walkover.....	16
3.1.1	Macrophyte species .....	16
3.1.2	Annex I habitat 3260 .....	18
3.1.3	Vegetation community.....	19
3.1.4	Condition assessment .....	21
3.2	<i>Callitriche truncata</i> survey .....	22
3.3	Ecological evaluation.....	23
	<b>REFERENCES .....</b>	<b>23</b>

## 1 INTRODUCTION

### 1.1 Background

Denyer Ecology was commissioned to undertake an aquatic macrophyte survey of a section of the River Slaney for the proposed Enniscorthy Flood Defence Scheme (EFDS). The flood relief works will be undertaken on the River Slaney, which is located within a Special Area of Conservation. Floating River Vegetation (3260) is one of the qualifying interests of this protected site (NPWS, 2011a).

### 1.2 Aims

There were two aims of the survey:

1. To determine whether the survey area has the potential to support the Annex I habitat 3260 'Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitriche-Batrachion* vegetation' (referred to in this report as 3260 or Floating River Vegetation).
2. To determine whether the survey area has the potential to support the protected plant species Short-leaved Water-starwort *Callitriche truncata* and Opposite-leaved Pondweed *Groenlandia densa*.

### 1.3 Statement of authority

Dr Joanne Denyer is a highly experienced botanist and bryologist with over 15 years' experience of ecological survey and research. She holds a first class honours degree in Environmental Science from Leicester University. She completed a DPhil in Plant Ecology (grassland ecology) at the University of Sussex and subsequently worked on the impacts of land-use, climate change and grazing on upland plant communities at the Macaulay Institute in Aberdeen (now James Hutton Institute). She is a full member of the Chartered Institute of Ecology and Environmental Management. Skills from her academic and research background include a high standard in experimental design, report writing, data collation, literature review and data analysis. Dr Denyer has published in high-ranking international peer-reviewed journals and presented data at over ten international conferences. She is an Adjunct Lecturer at National University of Ireland, Galway (NUIG), Guest Lecturer at University College Dublin (UCD) and Visiting Research Fellow at Queen's University Belfast.

Dr Denyer is experienced in the identification of all plant groups, including difficult groups such as aquatic macrophytes, charophytes and bryophytes. She received the National Biodiversity Data Centre 'Distinguished Recorder Award' in 2014 in recognition of outstanding contribution to bryological recording in Ireland. She regularly provides botanical and bryological training courses for amateurs and professionals and leads training meetings for the British Bryological Society (Irish group), Dublin Naturalist Field Club and the Botanical Society of the British Isles. Training courses provided include grass, sedge and rush identification, bryophyte and Sphagnum identification and using bryophytes as habitat indicators. She also lectures on bryophyte ecology to undergraduates at NUIG and UCD and leads field trips.

Dr Denyer specialises in botanical, wetland and bryological survey in the Republic of Ireland and Northern Ireland. She is experienced in Habitat Survey (Ireland), Irish Vegetation Classification (IVC) survey, Phase 1 Habitat survey (UK), detailed botanical survey, National Vegetation Classification (NVC), rare plant survey and vegetation monitoring. She is highly experienced in wetland surveys including lowland and upland fens, springs and flushes; raised and blanket bogs and transition mire; wet woodlands and aquatic macrophytes of rivers, lakes and ditches. She has undertaken wetland surveys in Ireland and the UK for a range of projects such as flood defence schemes, local development plans, road schemes, reservoir enhancement, conservation monitoring, post-construction monitoring, windfarm and other developments. In addition she has undertaken Ecological Impact Assessments for wetland sites and acted as an expert witness on calcareous springs and wetland vegetation at an Oral Hearing (2014).

She is frequently employed as a specialist botanist by other ecological consultancies to provide expertise and advice on habitat survey and assessment, in particular wetland and bryophyte dominant habitats.

## 2 METHODOLOGY

### 2.1 Study area

The survey area for the EFDS is a 4km stretch of the River Slaney to the north and south of Enniscorthy (Figure 2.1). General aquatic plant surveys were located in this area to update those undertaken for the project in 2003. It was considered highly unlikely that *Callitriche truncata* or *Groenlandia densa* would be recorded within the FDS 2016 survey area, as there are no recent or historic records and the area was surveyed thoroughly for aquatic plants in 2003. However, given the rarity of *Callitriche truncata* in Ireland, additional survey sites for this species were included to the south (details in Section 2.6).

Figure 2.1: Enniscorthy Flood Defence Scheme main survey area



### 2.2 Definition of Annex I priority habitat 3260 Floating River Vegetation

There is no standard Irish definition for the Annex I priority habitat 3260. Therefore, relevant information (from national and European reports and guidance documents) on the identification of 3260 Floating River Vegetation is summarised below. This information was used to assess whether the

macrophyte vegetation within the surveyed sections corresponds to 3260. In particular, it was used to identify aquatic macrophyte species that may be indicator species for 3260.

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

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

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

- Species – *Ranunculus trichophyllus*, *Ranunculus penicillatus*, *Ranunculus peltatus*, *Ranunculus aquatilis*, *Myriophyllum* spp., *Callitriche* spp., *Sium erectum* (*Berula erecta*), *Zannichellia palustris*, *Potamogeton* spp., and *Fontinalis antipyretica*.
- The plants characteristic of the habitat are listed in the Interpretation Manual (EC, 2003) and include a number of *Ranunculus* species and all *Callitriche* species, including other submerged aquatic plants.
- The community *Callitricho–Batrachion* is described in White and Doyle (White and Doyle, 1982) and includes species of the *Ranunculus* subgenus *Batrachium* and two species of *Callitriche*, *C. hamulata* and *C. platycarpa* as diagnostic species.
- There are few published records for descriptions of this habitat in Ireland and no comprehensive island-wide descriptions. No specific assessments of typical species have been undertaken to date.
- The EU (2003) definition of this habitat is very broad, especially when the presence of aquatic mosses is taken into account. Using this broad definition the habitat will be found in most watercourses in Ireland. Despite work by Kelleher (2011), there is to date no accepted definition of this habitat, its sub-types and their distribution in Ireland. Consequently there is a lack of relevant monitoring data concerning the habitat.
- The description of habitat 3260 is broad, covering rivers from upland bryophyte and macroalgal dominated stretches, to lowland depositing rivers with pondweeds and starworts (EC, 2007; Hatton-Ellis and Grieve, 2003). Selection of Special Areas of Conservation for the habitat in Ireland has used this broad interpretation. Thus, it must be recognised that a number of sub- types of this habitat exist in Ireland. As in the UK, it is considered that the habitat as defined is too broad for a single set of conservation guidelines to cover it (Hatton-Ellis and Grieve, 2003).

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

- The data from the current work and from previous studies does not aid habitat definition in the traditional phytosociological and objective sense and so a more subjective approach is necessary.
- Habitat definition - Floating River Vegetation definition can be restricted to that given by White and Doyle (1982) as the *Callitricho–Batrachion* community which includes species of the *Ranunculus* subgenus *Batrachium* and two species of *Callitriche*, *C. hamulata* and *C. platycarpa* as diagnostic species.
- There are two dominant species of *Ranunculus* in FRV in the Republic of Ireland, these are *R. penicillatus* and *R. peltatus*.
- The results from a molecular analysis of *Ranunculus* specimens suggests that: 1) either *R. penicillatus* contains a number of haplotypes and *R. peltatus* was not found in the surveys; or, 2) they should both be considered part of a single *R. penicillatus/peltatus* species complex.

#### 2.2.4 River Slaney SAC Conservation Objectives (NPWS, 2011)

- The sub-types of this habitat are poorly understood and their typical species have not yet been defined. Additional typical species and appropriate targets may emerge. The typical species of the tidal sub-type in the Slaney include *Callitriche truncata*, *Groenlandia densa*, *Myriophyllum spicatum*, other pondweeds (*Potamogeton* spp.), as well as pioneer vegetation of bare mud, e.g. *Eleocharis acicularis*. The invasive macrophyte *Elodea nuttallii* is also known to occur in the tidal stretch of the Slaney. Typical species may include higher plants, bryophytes, macroalgae and microalgae.

#### 2.2.5 Site Synopsis: Slaney River Valley SAC (NPWS, 2014)

- Floating River Vegetation is found along much of the freshwater stretches within the site. Species present here include *Ranunculus peltatus*, other water-crowfoot species, *Elodea canadensis*, *Potamogeton natans*, *Myriophyllum* spp., *Scirpus lacustris*, *Callitriche* spp., *Oenanthe crocata*, *O. aquatica*, *Lemna minor*, *Nuphar lutea*, *Sparganium emersum* and the moss *Fontinalis antipyretica*. Two rare aquatic plant species which are legally protected under the Flora (Protection) Order, 1999, have been recorded in this site: *Callitriche truncata*, a very rare, small aquatic herb found nowhere else in Ireland, and *Groenlandia densa*.

#### 2.2.6 JNCC Background to 3260 SAC Site selection

- This habitat type is characterised by the abundance of water-crowfoots *Ranunculus* spp., subgenus *Batrachium* (*Ranunculus fluitans*, *R. penicillatus* ssp. *penicillatus*, *R. penicillatus* ssp. *pseudofluitans*, and *R. peltatus* and its hybrids).
- There are several variants of this habitat in the UK. In each, *Ranunculus* species are associated with a different assemblage of other aquatic plants, such as *Rorippa nasturtium-aquaticum*, *Callitriche* spp., *Sium latifolium* and *Berula erecta*, *Myriophyllum* spp. and *Myosotis scorpioides*. In some rivers, the cover of these species may exceed that of *Ranunculus* species.
- Sub-type 1 is found on rivers on chalk substrates. The community is characterised by *Ranunculus peltatus* (spring-fed headwater streams), *R. penicillatus* ssp. *pseudofluitans* (middle reaches), and *R. fluitans* (downstream sections). *Ranunculus* is typically associated in the upper and middle reaches with *Callitriche obtusangula* and *C. platycarpa*.
- Sub-type 2 is found on other substrates, ranging from lime-rich substrates, through soft sandstone and clay to more mesotrophic and oligotrophic rocks. Faster-flowing western rivers on harder rocks support *Ranunculus penicillatus* ssp. *penicillatus*, while western and northern rivers on sandstone or alluvial substrates often support both *R. penicillatus* ssp. *penicillatus* and *R. fluitans*. Elsewhere in the UK they contain a mixture of species, and hybrids, but rarely support *R. penicillatus* ssp. *penicillatus* or *R. fluitans*. Associated species include *Berula erecta*, *Callitriche obtusangula*, *Potamogeton crispus*, *P. pectinatus* and *Zannichellia palustris*. *Butomus umbellatus* is an occasional bank-side associate.
- Sub-type 3 is a mesotrophic to oligotrophic community found on hard rocks in the north and west. Rivers in Wales, Northern Ireland and south-west England are significant for the occurrence of *Ranunculus penicillatus* ssp. *penicillatus*. Other typical species include the *Fontinalis squamosa*, *Myriophyllum alterniflorum* and *Callitriche hamulata*. More oligotrophic examples of this community lack *Ranunculus* spp. and are dominated by *M. alterniflorum*, *C. hamulata* and *Potamogeton polygonifolius*.
- 3260 is widespread in Europe, though examples on chalk (sub-type 1) are rare
- 3260 is widespread in rivers in the UK, especially on softer and more mineral-rich substrates.

### 2.3 Classification of Floating River Vegetation

#### 2.3.1 Classification of 3260 vegetation communities in Ireland

White and Doyle (1982) briefly describe a range of aquatic plant communities, including the *Callitricho-Batrachion* community. This is described as being typical vegetation of periodically dried-out streams, ditches and cattle drinking pools. The diagnostic species are listed as *Ranunculus* sub-

genus *Batrachium*, *Callitriche hamulata* and *C. platycarpa*. *Potamogeton perfoliatus* and *Myriophyllum* sp. are listed as associate species. In addition, some alliances within the Pondweed class (*Potametea*) would fit the broad approach to classification of this habitat (see Section 2.2). As described in Section 2.2, there is currently no accepted definition or classification of this habitat in Ireland.

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

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

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

- CB1: Lowland, low-gradient *Potamogeton/Sagittaria* eutrophic river community
- CB2: Base-rich *Ranunculus penicillatus* ssp. *pseudofluitans*-*Callitriche obtusangula* rivers, including chalk streams
- CB3: Large *Ranunculus* rivers
- CB4: Smaller meso-eutrophic rivers
- CB5: Atlantic bryophyte *Callitriche hamulata*/*Ranunculus penicillatus* ssp. *penicillatus* rivers
- CB6a: Slow-flowing, base-poor rivers
- CB6b: Fast-flowing, bryophyte-dominated rivers

The approach was taken of classifying 500m river sections, identifying individual communities within these sections. This is because many 'communities' identified at a smaller scale are in fact patches of individual species.

## 2.4 Condition assessment

As described in Section 2.2, 3260 habitat in Ireland and the UK is considered too broad for a single set of conservation guidelines to cover it. There is currently a lack of monitoring data and criteria for this Annex I habitat in Ireland. In the UK, the current Common Standards Monitoring Guidance for rivers (JNCC, 2014) uses River Habitat Survey to assess and monitor the physical characteristics of rivers and LEAFACS for macrophyte and macroinvertebrate assemblages. This survey focuses on the macrophyte communities of the River Slaney survey area (the physical characteristics are assessed elsewhere). LEAFACS (see Wilby et al., 2012 for full details) uses a scoring system to assess the ecological condition of rivers. This is based on macrophyte species composition, richness and abundance of certain species to produce a metric that reflects the ecological status of a river. There has been no assessment of the applicability of this approach to Irish rivers. Given the difference in habitat requirements and tolerances of some key species found in the River Slaney (e.g. *Ranunculus penicillatus* subsp. *penicillatus*), this was not considered to be a method that could currently be used to assess condition in this project.

Hatton-Ellis & Grieve (2003) list some broad criteria for assessing river condition. There can be large inter-annual variation in species composition and abundance, which will affect the assessment of condition from year to year. Therefore condition assessment should be based on monitoring data over time (Hatton-Ellis & Grieve, 2003).

Those criteria that are relevant to this survey and assessment are listed below:

- The vegetation should be characteristic for the river type. Extensive filamentous and epiphytic (diatomaceous) alga indicate unfavourable conditions.

- Flow should be characteristic for the catchment type (at least 90% of the naturalised daily mean flow should be maintained).
- Channel substrate should be predominantly free of silt (not applicable to communities CB1 and CB6a). Typically the predominant substrate should include cobbles, pebbles and gravel.
- Where the physical structure, water quality and quantity are satisfactory, the diversity and abundance of the plant community is likely to indicate favourable conservation status.

For each Floating River Vegetation community (CB1 to CB6), the typical species and species richness (number of vegetation components) are listed. In the absence of other monitoring methods, these have been used to broadly assess macrophyte condition in this project. However, there is currently no data as to how applicable this data is to Irish rivers.

## 2.5 Desktop data

### 2.5.1 Floating river vegetation

Baseline aquatic macrophyte surveys were undertaken in 2003 (Goodwillie & Associates, 2003). Very little aquatic macrophyte growth was recorded from the survey area during this survey. However, five species that are indicative of Floating River Vegetation (see Section 2.2) were recorded from within the 2016 survey area (Figure 2.1):

*Callitriche cf stagnalis*\*

*Potamogeton natans*

*Potamogeton perfoliatus*\*

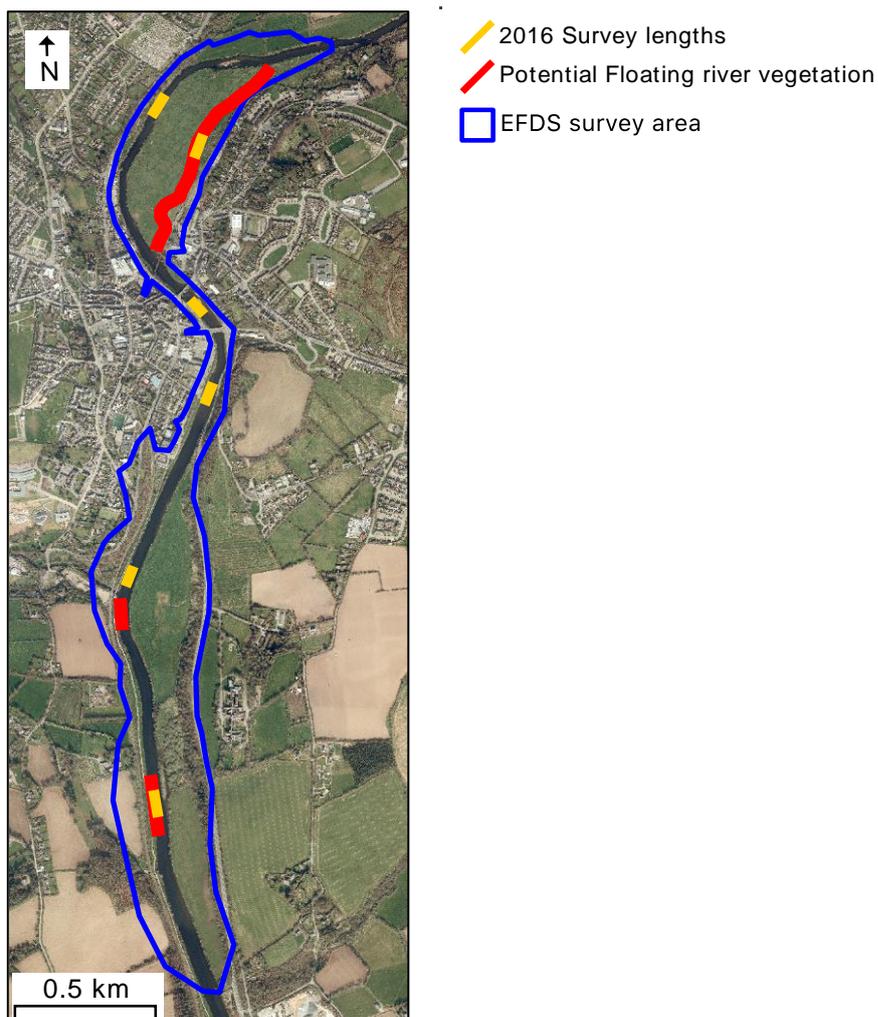
*Myriophyllum spicatum*

*Ranunculus penicillatus* (*Ranunculus penicillatus* subsp. *penicillatus*)\*

Those marked with an asterisk have also been recorded from the study area by Paul Green (records provided by Wexford (H12) BSBI Vice County Recorders P.G. Green and P.O'Meara).

Based on these records, the location of potential Floating River Vegetation is shown on Figure 2.2. The 2016 survey lengths (also shown on Figure 2.2) were targeted to include these areas where possible.

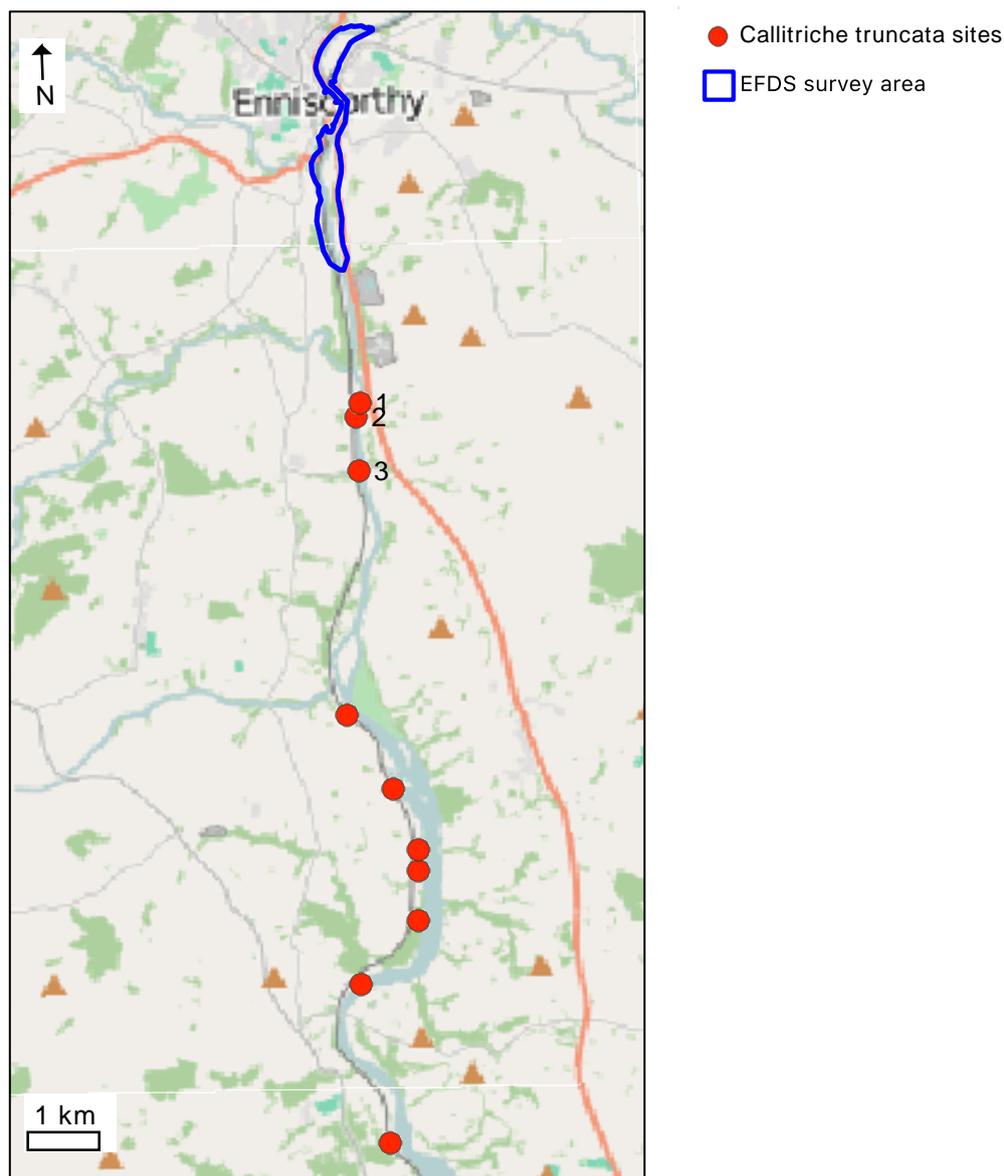
**Figure 2.2. Location of potential Floating River Vegetation based on 2003 survey data**



### 2.5.2 *Callitriche truncata* and *Groenlandia densa*

Species records for *Callitriche truncata* and *Groenlandia densa* within/ near survey area:

- *Groenlandia densa* was recorded from Macmine Junction (S9731) in 1897, but there are no recent records. *G. densa* has not been recorded within the FDS potential zone of influence; the closest record is approximately 6km south of this area (Macmine Junction).
- *Callitriche truncata* has been recorded from a number of locations on the River Slaney, south of Enniscorthy from 1897 to 2012. A map of the known locations is shown in Figure 2.3. *C. truncata* has not been recorded within the FDS potential zone of influence; the closest record is approximately 1.8km south of this area (opposite Brownswood Castle).

Figure 2.3: Known locations of *Callitriche truncata* on the River Slaney

Numbers refer to 2016 survey sites (see text for details)  
© OpenStreetMap contributors

## 2.6 Field survey

### 2.6.1 General aquatic survey of FDS potential zone of influence

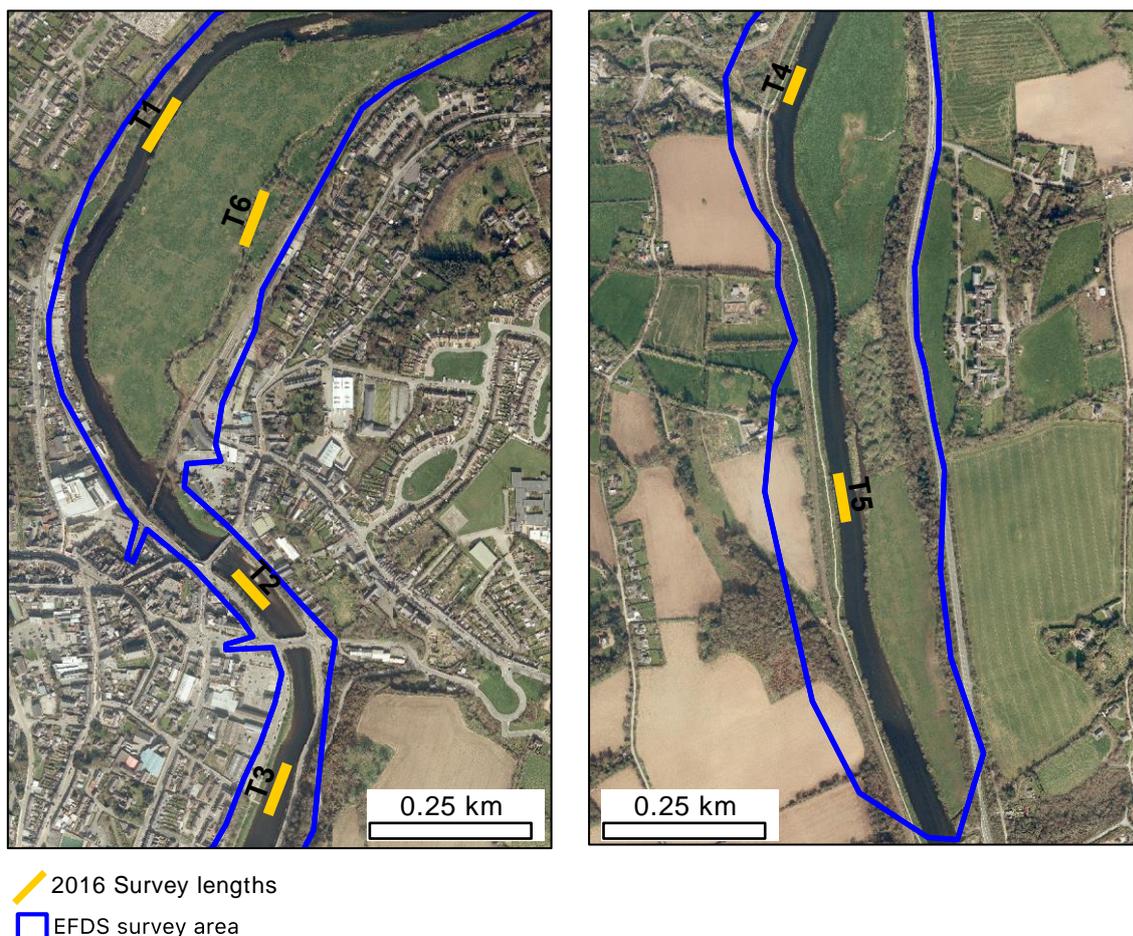
The survey method is based on the following standard methodologies for surveying macrophytes in rivers:

- UK Common Standards Monitoring (CSM) Guidance for Rivers (JNCC, 2014)
- River Leafpacs 2 (WFD-UKTAG, 2014)
- The Ecological Classification of UK rivers using aquatic macrophytes (Wilby et al., 2012)
- Guidance for the surveying of aquatic macrophytes in running waters (EN 14184:2014) S.I. No. 277 of 2016.

The standard survey methodology (above) for aquatic macrophytes is to undertake detailed transects at appropriate intervals within a survey area. The full length of a survey area is not surveyed in this detail. Within the c 4.0km main survey area (Figure 2.1), representative 100m survey lengths

(transects) of river were surveyed for aquatic macrophytes. This is a practical length for detailed field survey, is likely to be a homogenous reach and is the most common sample length employed in river macrophyte surveys in Europe (Wilby et al., 2012). The recommended minimum number of transects is one per km (i.e. four sections). Five transects were actually undertaken to ensure that the full variation of macrophyte vegetation within this area was surveyed, including areas highlighted in the 2003 surveys (Goodwillie & Associates, 2003; Figure 2.2). Transects T1 to T5 were located on the main River Slaney. In addition, one transect (T6) was recorded in a back channel on the northern floodplain; this was highlighted as being relatively diverse in the 2003 surveys (Goodwillie & Associates, 2003). Transect location is shown on Figures 2.2 and 2.4.

**Figure 2.4: Location of transects surveyed in 2016**



The transects were surveyed from one or both riverbanks (as appropriate for each transect) using a grapnel (Photograph 2.1). This depended on the width of the river in that location and whether aquatic macrophytes were present on both sides of the channel. In addition, most of the river length was walked from one or both riverbanks and additional areas of aquatic macrophytes noted. This gave a thorough coverage of the survey area and it was not considered that any areas of Floating River Vegetation present in 2016 were undetected.

The survey focused on aquatic macrophytes (submerged and floating) and percentage cover of these species was estimated. Brief notes were made on the river physical characteristics and bank vegetation, but River Habitat Survey and detailed bank vegetation survey were not within the scope of these surveys (to be undertaken separately by different surveyors). Areas where protected fauna species, such as Freshwater Pearl Mussel, had been recorded (at the time of survey) were avoided when the transect locations were selected. Transects were selected using a GIS package to avoid bias

in the field when selecting sites (but were selected to include areas identified as supporting aquatic macrophyte vegetation in 2003). One transect (T4) was moved to the north during fieldwork, as the original transect location below the mouth of the River Urrin (highlighted in 2003; Figure 2.2) had little macrophyte cover in 2016. It was also difficult to use a grapnel in the southern area as there was scrub cover on the bank. The area to the north had relatively high macrophyte abundance and diversity. Therefore the 2016 transect (T4) was located to in this area (Figure 2.4). The exact location of the northern point of each transect was recorded using a GPS device.

Where possible, all taxa (excluding macroalgae) were identified to species level. For some species, identification to species level required particular features, such as fruits or flowers, to be present. Where these were absent, it was not always possible to identify to species level. The percentage cover of each taxa was estimated by eye and abundance/ frequency in grapnel samples.

The surveys were undertaken in July 2016, to maximise the number of species recorded and the probability that key identification features would be present.

**Photograph 2.1. Grapnel with abundant *Potamogeton perfoliatus* (Transect T5)**



### 2.6.2 *Callitriche truncata* survey

In addition to the main survey area, additional sites south of the EFDS study were surveyed for *Callitriche truncata* (Table 2.1, Figure 2.3). These are areas where the species has previously been recorded. The only known site for *Groenlandia densa* (Macmine junction) was not surveyed, as this is c 6.0km south of the potential zone of influence of the project. *Callitriche truncata* was recorded from this site in 2012 (P.G.Green).

**Table 2.1: *Callitriche truncata* survey sites**

Site	Grid reference	Distance from FDS potential zone of influence	Most recent record <sup>1</sup>
1) Opposite Brownwood castle <sup>2</sup>	S977355	c 1.8km south	Oct 2003 (R.N.Goodwillie) <sup>3</sup>
2) West bank of River Slaney below Bormount House <sup>2</sup>	S976353	c 2.0km south	July 2003 (R.N.Goodwillie)

Site	Grid reference	Distance from FDS potential zone of influence	Most recent record <sup>1</sup>
3) Edermine Bridge	S977345	c 2.8km south	June 1990 (Lady R.Fitzgerald)

<sup>1</sup>Records provided by Wexford (H12) BSBI Vice County Recorders P.G. Green and P.O'Meara and NPWS.

<sup>2</sup>Lady R.Fitzgerald recorded another *Callitriche* species (*Callitriche brutia* subsp. *hamulata*) from a dyke running parallel to these sites during the same visit as she recorded *C. truncata* from site 3 (June 1990). It is highly likely that she surveyed sites 1 and 2 during this time, but no *C. truncata* was recorded.

<sup>3</sup>Single stem dredged from the river at this location

The survey aims were to determine: a) whether the species is still present in these locations; and, b) to assess the current populations. At these sites, *Callitriche truncata* has been recorded from shallow water, usually near the river edge or in shallow inlets. Therefore surveys were undertaken either by grapnel from the riverbank or wading in shallow water. Survey method: the method that will cause the least disruption to the species and its habitat was chosen at each location. Where encountered, the area covered by *Callitriche truncata* at each location will be estimated *in situ* as far as possible to avoid disturbance. Survey methodology at each site:

- Grid reference will be taken for each population and, if relevant, the upstream and downstream limits at each site.
- Estimate of population size (number of plants if small population and/ or area covered).
- Habitat description and condition.
- A small voucher specimen from each site will be collected and will be subsequently lodged at the herbarium in the National Botanic Gardens, Glasnevin (DBN).

Where *Callitriche truncata* is encountered, it will be necessary to disturb at least one plant from each location to check for key identification characters (fruit) and to collect a voucher specimen. Very small populations will not be disturbed. *Callitriche truncata* tends to be a pioneer species and is often the first to colonise disturbed ground (Barry & Wade, 1986). Therefore small disturbance of a healthy population will not lead to an overall negative impact on the survival of *Callitriche truncata* populations at the survey sites.

## 2.7 Licence

A 'Licence to Take or Interfere with Protected Plant Species' under Section 21 of the Wildlife Act in relation to the aquatic plants: Short-leaved Water-starwort *Callitriche truncata* and Opposite-leaved Pondweed *Groenlandia densa* within the River Slaney Special Area of Conservation (SAC) was obtained from NPWS before any aquatic macrophyte surveys were undertaken. A detailed methods statement was submitted to NPWS and these methods were followed during the surveys (as described in this report).

## 2.8 Microscope identification, voucher specimens and referees

A specimen of each aquatic macrophyte species recorded was collected as a voucher specimen for future reference. In addition, specimens were collected where identification was not possible in the field, where a herbarium voucher was required or where specialist confirmation of rare or critical taxa was required.

## 2.9 Plant species nomenclature

Vascular plant nomenclature will follow that of the *New Flora of the British Isles*. 3rd Edition. (Stace, 2010). The bryophyte nomenclature adopted by Lockhart et al. (2012) will be used; this is based on the *Checklist of British and Irish bryophytes* (Hill et al., 2009) with minor modifications to reflect recent taxonomic changes.

## 2.10 Limitations

There were no major limitations in relation to the survey work. The general aquatic macrophyte grapnel survey was undertaken from the riverbank. As aquatic vegetation was generally located within 1-2m of the banks, it is not considered that this impacted the survey data collected. Transect T2 was undertaken at low tide as gravel banks are exposed at low tide so this maximised the possibility of recording species. The *Callitriche truncata* sites 1 and 2 are located on a muddy bank, which is only exposed at low tide. Therefore the surveys were undertaken on a falling tide, just before low tide. Again the survey was undertaken from the shore using a grapnel, but the furthest extent of aquatic vegetation was clearly visible and was possible to sample. It is therefore not considered that this limited the survey data collected at these sites.

*Callitriche truncata* was not recorded at any of the known sites during the 2016 survey (see Results section). Previous records of *Callitriche truncata* have been made from mid-June to October, with a

number of records made from June to July. Therefore it is not considered that the absence of this species from these sites in 2016 was due to survey timing.

### 3 RESULTS AND EVALUATION

#### 3.1 Aquatic macrophyte transects and general walkover

The full data for the aquatic macrophyte transects is shown in Appendix A. This includes the transect grid reference, representative photographs, notes on water quality, flow, substrate and bank vegetation and macrophyte species presence and abundance.

##### 3.1.1 Macrophyte species

The following aquatic macrophyte (including bryophyte) species were recorded from the survey area:

***Callitriche stagnalis***

*Elodea canadensis* (Photograph 3.1)

*Elodea nuttallii*<sup>2</sup> (Photograph 3.2)

*Lemna minor*

***Myriophyllum spicatum*** (Photograph 3.3)

*Potamogeton berchtoldii*<sup>2</sup>

***Potamogeton natans***

***Potamogeton perfoliatus*** (Photograph 3.4)

***Potamogeton x cooperi***<sup>2</sup> (Photograph 3.5)

***Ranunculus cf penicillatus subsp. penicillatus***<sup>1</sup> (Photograph 3.6)

*Sparganium emersum*

Bold = Indicator species for 3260 Floating River Vegetation

<sup>1</sup>not possible to confirm ID as non-flowering at time of survey

<sup>2</sup>not recorded from within 2016 survey area in 2003 aquatic macrophyte survey

*Potamogeton x cooperi* is a rare hybrid in the Republic of Ireland. It is a hybrid between *P. perfoliatus* and *P. crispus* and can arise in situ or be present in the absence of both parent species (Stace, 2015). It has only been recorded from Sligo and Wexford in the Republic of Ireland (Hackney, 1981), in three hectads. There is a historic record (1962) from the Owenmore River in G61, Co. Sligo (D.Cotton, pers.comm.) and more recent records from S85 and S95 near Bunclody, Co. Wexford (P.G.Green, pers.comm.). This therefore represents only the third recent hectad record for the Republic of Ireland. This hybrid was recorded from the River Slaney, above the junction with River Urrin, Co. Wexford (transect T4, S 9719 3886). It was growing in the river channel with *Potamogeton perfoliatus* and *Myriophyllum spicatum*, c 2m from the western bank.

**Photograph 3.1-3.6 Examples of aquatic macrophyte species recorded during transect survey**

**Photograph 3.1. *Elodea canadensis***



**Photograph 3.2. *Elodea nuttallii***



**Photograph 3.3. *Myriophyllum spicatum***



**Photograph 3.4. *Potamogeton perfoliatus***



**Photograph 3.5. *Potamogeton x cooperi*  
(*P.perfoliatus* x *P. crispus*)**



**Photograph 3.6. *Ranunculus cf penicillatus*  
subsp. *penicillatus***



### 3.1.2 Annex I habitat 3260

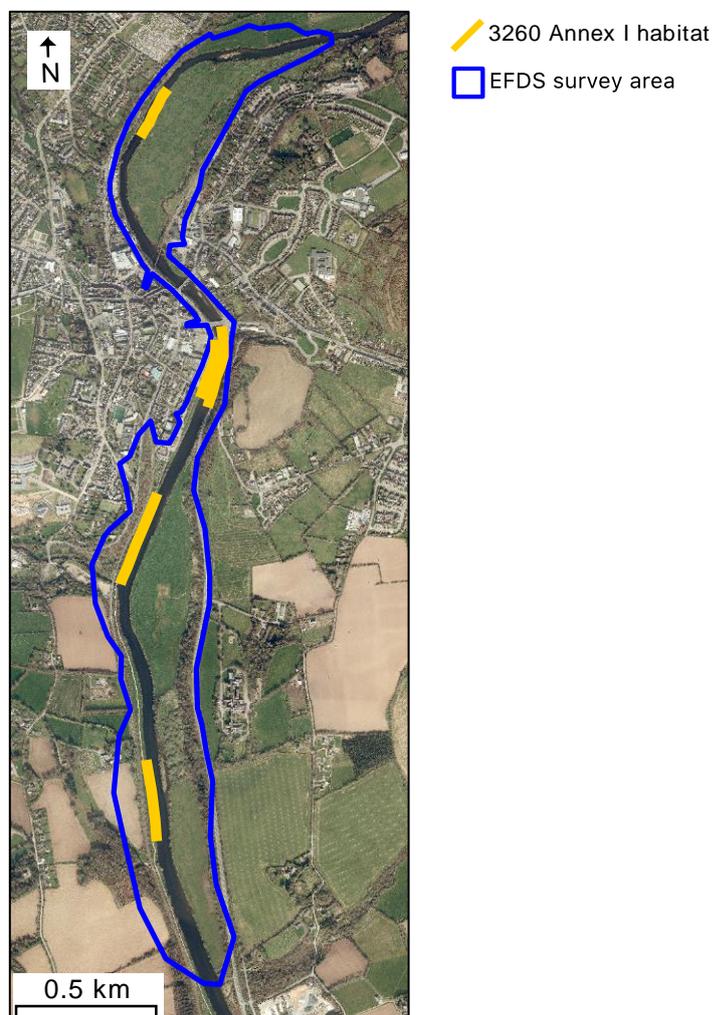
The affinity of the transect vegetation to the Annex I habitat 3260 Floating River Vegetation is shown in Table 3.1. Transects T1, T3, T4 and T5 in the main river channel all correspond to 3260 Annex I habitat using the broad definition in the latest Article 17 report (NPWS, 2013) and other relevant references (Section 2.2). T2 in the main river channel does not have suitable substrate/ flow for this Annex I habitat type and T6 is located in a small back channel which is shaded with low flow, again unsuitable for 3260 Annex I habitat. The location of the Annex I habitat 3260 within the survey area is shown on Figure 2.5. This includes areas outside of the transect locations, that were mapped during the general walkover.

**Table 3.1. Affinity of transect vegetation to Annex I habitat Floating River Vegetation**

Transect number	3260 indicator species present	3260 habitat present
T1	<i>Fontinalis antipyretica</i> , <i>Potamogeton perfoliatus</i> , <i>Ranunculus cf penicillatus</i> subsp. <i>penicillatus</i>	<b>Yes.</b> Three 3260 indicator species present, although of low cover.
T2	None	<b>No.</b> No aquatic macrophyte vegetation due to substrate.
T3	<i>Callitriche stagnalis</i> , <i>Myriophyllum spicatum</i> , <i>Potamogeton perfoliatus</i> , <i>Ranunculus cf penicillatus</i> subsp. <i>penicillatus</i>	<b>Yes.</b> Four 3260 indicator species present and some species locally abundant near riverbanks.
T4	<i>Callitriche stagnalis</i> , <i>Myriophyllum spicatum</i> , <i>Potamogeton perfoliatus</i> , <i>Potamogeton x cooperi</i>	<b>Yes.</b> Four 3260 indicator species present including one rare hybrid.
T5	<i>Callitriche stagnalis</i> , <i>Potamogeton perfoliatus</i>	<b>Yes.</b> Only two 3260 indicator species present but <i>P. perfoliatus</i> very abundant and fits within the broad description of this habitat in Ireland/ Europe.

Transect number	3260 indicator species present	3260 habitat present
T6	<i>Callitriche stagnalis</i> , <i>Potamogeton natans</i>	<b>No.</b> Although one <i>Callitriche</i> species and one <i>Potamogeton</i> species present, the vegetation and habitat are not typical for 3260

Figure 2.5. Location of Annex I habitat Floating River Vegetation within survey area



### 3.1.3 Vegetation community

The macrophyte vegetation community recorded has most affinity with the UK vegetation community classification (Hatton-Ellis & Grieve, 2003): **CB3 - Large *Ranunculus* rivers** and, to a lesser extent: **CB1 - Lowland, low-gradient *Potamogeton/Sagittaria* eutrophic river community**. The typical species for each community are listed in Tables 3.2 and Table 3.3. These descriptions indicate the species most often dominant in each of the seven vegetation components, and species commonly associated with them. Note that not all species need to be present for a site to fall into a particular type (Hatton-Ellis & Grieve, 2003). Sensitive species (i.e. those most likely to be lost following ecological damage or disturbance) are indicated by \* and Opportunist species (those most likely to increase following disturbance) are indicated by \*\*. These species may be characteristic of the community and are not in themselves indicative of poor condition. However, sections containing only these species, or extensive cover of these species, should be viewed as potentially impacted by disturbance (Hatton-Ellis & Grieve, 2003).

*Ranunculus penicillatus* subsp. *penicillatus* is not listed for either community (**CB1** or **CB3**). However, as stated in Section 2.3.2, this species tends to only occur in base-poor water in Britain, whereas in Ireland it has a much broader ecological tolerance and distribution. <sup>[1]</sup><sub>SEP</sub>

The transect vegetation has frequently abundant *Ranunculus penicillatus* subsp. *penicillatus*, *Potamogeton perfoliatus* and *Myriophyllum spicatum* and therefore fits most closely with **CB3**. These are described (Hatton-Ellis & Grieve, 2003) as large rivers (often over 20m wide), frequently with wooded banks, which is not typical of this section of the River Slaney. However the flow (moderate to rapid and somewhat variable) and geology (sandstone or hard limestone, resulting in fairly base-rich, mesotrophic to eutrophic conditions) are more typical. For the **CB1** community, *Potamogeton perfoliatus* and *Myriophyllum spicatum* are frequent but not usually abundant. However, this community is described as being characterised by prominent *Potamogeton* spp. and *Myriophyllum spicatum*, with *Ranunculus* species less noticeable than in many other CB types (Hatton-Ellis & Grieve, 2003).

It is therefore concluded that the transects have most affinity overall (based on the classification data output shown in Tables 3.2 and 3.3) to **CB3**, but have some affinity to **CB1**. This discrepancy is likely to be because the classification system was not developed using Irish data.

**Table 3.2. Typical species for CB1: Lowland, low-gradient *Potamogeton/Sagittaria* eutrophic river community**

Species group	Frequently abundant (cover >5% in ≥50% sites)	Frequently present (occurs in ≥50% sites but not usually abundant)
Crowfoots	<i>Ranunculus penicillatus</i> subsp. <i>fluitans</i>	<i>Ranunculus fluitans</i> *
Starworts		<i>Callitriche platycarpa</i> * <i>Callitriche stagnalis</i> **
Pondweeds	<i>Potamogeton pectinatus</i> **	<i>Potamogeton crispus</i> ** <i>Potamogeton lucens</i> * <i>Potamogeton natans</i> * <b><i>Potamogeton perfoliatus</i>*</b> <i>Zannichellia palustris</i> <sup>[1]</sup> <sub>SEP</sub>
Milfoils		<b><i>Myriophyllum spicatum</i>**</b>
Bryophytes		<b><i>Fontinalis antipyretica</i>*</b> <i>Leptodictyum riparium</i> ** <i>Platyhypnidium riparioides</i>
<b>Other aquatics</b>	<i>Nuphar lutea</i> <i>Sagittaria sagittifolia</i>	<i>Butomus umbellatus</i> <i>Oenanthe fluviatilis</i>
<b>Marginal species</b>	<i>Rorippa nasturtium-aquaticum</i>	<i>Apium nodiflorum</i>

**Table 3.3. Typical species for CB3: Large *Ranunculus* rivers**

Species group	Frequently abundant (cover >5% in ≥50% sites)	Frequently present (occurs in ≥50% sites but not usually abundant)
Crowfoots	<i>Ranunculus penicillatus</i> subsp. <i>fluitans</i> <i>Ranunculus fluitans</i> *	
Starworts		
Pondweeds	<i>Potamogeton pectinatus</i> ** <b><i>Potamogeton perfoliatus</i></b>	<i>Potamogeton crispus</i> ** <i>Zannichellia palustris</i> <sup>[1]</sup> <sub>SEP</sub>
Milfoils	<b><i>Myriophyllum spicatum</i>**</b>	
Bryophytes	<i>Fontinalis antipyretica</i> <i>Platyhypnidium riparioides</i> *	<i>Hygroamblystegium fluviatile</i> <i>Leptodictyum riparium</i> ** <i>Cinclidotus fontinaloides</i> <i>Pellia endiviifolia</i>

Species group	Frequently abundant (cover >5% in ≥50% sites)	Frequently present (occurs in ≥50% sites but not usually abundant)
Other aquatics		<i>Butomus umbellatus</i>
Marginal species		<i>Apium nodiflorum</i> <i>Rorippa nasturtium-aquaticum</i>

### 3.1.4 Condition assessment

The Hatton-Ellis & Grieve (2003) vegetation community classification lists the guideline number of vegetation components that are expected per 500m site. This can be used to assess community condition. The ‘vegetation components’ are those listed for each community in Tables 3.2 and 3.3. For **CB3 - Large *Ranunculus* rivers**, the typical number of vegetation components is **5-6**. This community type is typically less diverse than others and 5 of the 7 vegetation components constitutes an acceptable threshold (Hatton-Ellis & Grieve, 2003).

The transect lengths for this project were 100m. However, additional data was recorded from the river upstream and downstream of each transect. The number of vegetation components for each extended transect are shown in Table 3.4. This only includes transects where the Annex I habitat 3260 was recorded. *Ranunculus penicillatus* subsp. *penicillatus* has been considered to be comparable to *Ranunculus penicillatus* subsp. *fluitans* and *Ranunculus fluitans*.

**Table 3.4. Condition assessment for CB3, based on typical species per 500m section**

Transect number	CB3 vegetation components present	Pass species condition assessment?
T1	<b>Five:</b> <i>Ranunculus</i> cf <i>penicillatus</i> subsp. <i>penicillatus</i> , <i>Potamogeton perfoliatus</i> , <i>Fontinalis antipyretica</i> , <i>Platyhypnidium riparioides</i> , <i>Pellia endiviifolia</i>	<b>Yes (≥5) vegetation components</b>
T3	<b>Five:</b> <i>Ranunculus</i> cf <i>penicillatus</i> subsp. <i>penicillatus</i> , <i>Potamogeton perfoliatus</i> , <i>Myriophyllum spicatum</i> , <i>Fontinalis antipyretica</i> , <i>Platyhypnidium riparioides</i>	<b>Yes (≥5) vegetation components</b>
T4	<b>Five:</b> <i>Ranunculus</i> cf <i>penicillatus</i> subsp. <i>penicillatus</i> , <i>Myriophyllum spicatum</i> , <i>Potamogeton perfoliatus</i> , <i>Platyhypnidium riparioides</i> , <i>Pellia endiviifolia</i>	<b>Yes (≥5) vegetation components</b>
T5	<b>Five:</b> <i>Ranunculus</i> cf <i>penicillatus</i> subsp. <i>penicillatus</i> , <i>Myriophyllum spicatum</i> , <i>Potamogeton perfoliatus</i> , <i>Fontinalis antipyretica</i> , <i>Platyhypnidium riparioides</i>	<b>Yes (≥5) vegetation components</b>

All of the transects with 3260 pass the ‘generic indicators of habitat quality in CB rivers’ listed in Hatton-Ellis & Grieve (2003) list key macrophyte community attributes indicative of habitat condition in 3260 rivers. These are summarised below for the 3260 areas within the River Slaney survey area. This does not include physical attributes, which were not the subject of this survey:

- 5 or more vegetation components present (**Yes** all 3260 ‘expanded transects’)
- CB communities present (**Yes**, CB3 in all 3260 ‘expanded transects’)
- Natural riparian community present (**Yes**, described in Appendix A)
- Healthy *Ranunculus* (if a common component of the CB community) **Yes**
- Typical assemblage and diversity (**Yes**, all 3260 transects have CB3 community, typical vegetation components, typical riparian community and one rare species recorded).

In the absence of a more detailed monitoring protocol, and one developed for Irish rivers, this condition assessment indicates that the **3260 Annex I habitat vegetation within the survey area is in good condition.**

### 3.2 *Callitriche truncata* survey

The results of the *Callitriche truncata* site surveys are shown in Appendix B. This contains the site location, data of last record, notes on survey access and timing, aquatic macrophytes recorded at each site and site photographs. *Callitriche truncata* was **not** recorded at any of the 3 survey sites where it had previously been recorded. As stated in Section 2.10, it was not considered that access or survey timing were limitations to the survey. Access was good at each site and water clarity allowed underwater plants to be visible from the shore. Previous records of *Callitriche truncata* on the River Slaney have been made from mid-June to October, with a number of records made from June to July. *Callitriche truncata* flowers from May to September and fruits from June to October (Barry & Wade, 1986). Therefore it is not considered that the absence of this species from these sites in 2016 was due to survey timing.

- **Site 1:** Lady R.Fitzgerald had recorded plants from a dyke parallel to sites 1 & 2 as part of her *Callitriche truncata* surveys in June 1990. It is not known if the shoreline was surveyed at this time, but no *Callitriche truncata* was recorded. R.Goodwillie recorded a single stem of washed up *Callitriche truncata* in this location in October 2003. It may be that it was a small, transient population of *Callitriche truncata* in this location.
- **Site 2:** As above, there are no records of *Callitriche truncata* from this site prior to those made in 2003 by R.Goodwillie. The notes from the record state '*In good quantity below Borrmount House on mud at west bank of Slaney with Elodea canadensis and E. nuttallii*'. The site was surveyed in July 2003, as in the 2016 survey. Although *Elodea nuttallii* was locally abundant, there were bare patches of exposed mud suitable for *Callitriche truncata*.
- **Site 3:** Several patches (c 50 x 50cm) of *Callitriche truncata* had been recorded from both sides of the River Slaney in this location in shallow, muddy inlets. Both inlets had bare mud present at low tide and species such as *Elodea nuttallii* and filamentous alga were not abundant. Therefore there appeared to be suitable habitat for *Callitriche truncata*. However, both inlets are fairly narrow and likely to be shaded for part of the day. This may have changed since 1990. The species has not been recorded at this site since 1990, although P.G.Green has surveyed the site since then (P.G.Green, pers.comm.)

*Callitriche truncata* is a poor competitor, but can occur in bare patches by itself, or with a species such as *Elodea canadensis* or filamentous alga (Barry & Wade, 1986). Where it occurs on its own, it is likely to be an initial colonising stage and when it grows with other species, this may represent a senescing stage resulting from competition from other species (Barry & Wade, 1986). It could be that at sites 1 and 2, the habitat is becoming overgrown with *Elodea nuttallii*, which can be a more aggressive invader than *Elodea canadensis*. It is not known exactly where the species was recorded (there is only a 6 figure grid reference and no map) and it could be that it was in the areas now dominated by *Elodea nuttallii* (e.g. Photographs 1.1 and 1.3, Appendix B). As stated above, the two inlets at site 3 are shaded by *Phragmites australis* and other tall species, and this may be shading the suitable habitat.

It is not possible to state that the species has been lost from these sites, as *Callitriche truncata* can reappear at a site after a significant absence above ground (Barry & Wade, 1986). It is suggested that the seeds may remain viable for at least 2-3 years (Barry & Wade, 1986).

In conclusion, ***Callitriche truncata* was not recorded from its three most northerly locations on the River Slaney** (survey sites 1 to 3). It may be that these sites no longer provide the open, early successional habitat preferred by this species (Barry & Wade, 1986). However, it may also be that *Callitriche truncata* is transient at these sites and may reappear in the future.

The ***Callitriche truncata* sites 1 to 3 are not within the potential zone of influence of the Enniscorthy FDS**. The closest site (site 1) is c 1.8km south of the potential zone of influence. As there are currently

no predicted impacts for this area, **it is not considered that further survey work is required at this stage**. If, however, the zone of influence is extended to the south, further survey work may be required. In this instance, it is recommended that in addition to rechecking sites 1 to 3, a boat be used to survey additional areas of exposed mud bank in these locations. As an early colonist, *Callitriche truncata* could invade new areas of mud bank, created for instance after a flooding event.

### 3.3 Ecological evaluation

The macrophyte vegetation within the survey area is considered to be the Annex I habitat 3260 Floating River Vegetation and is in good condition. It is located within the Slaney River Valley Special Area of Conservation. It is therefore considered to be of **International ecological importance** as part of the overall mosaic of 3260 vegetation within the SAC.

## REFERENCES

- BBS** (2009). *Checklist of British and Irish bryophytes*. The British Bryological Society, Stafford, U.K.
- Barry, R. & Wade, P. M.** (1986). Biological Flora of the British Isles. *Callitriche truncata* Guss. *Journal of Ecology*: 74 (1) 289-294.
- EC** (2007). *Interpretation Manual of European Union Habitats - EUR27*. European Commission.
- Hackney, P.** (1981). *Potamogeton × cooperi* (Fryer) and *P. × undulatus* Wolfg. in NE Ireland. *The Irish Naturalists' Journal*: 20 (6) 250-251.
- Hatton-Ellis, T.W. & Grieve, N.** (2003). *Ecology of Watercourses Characterised by Ranunculion fluitantis and Callitriche-Batrachion Vegetation*. Conserving Natura 2000 Rivers Ecology Series No. 11. English Nature, Peterborough.
- JNCC**. Background information on 3260 Rivers with floating vegetation often dominated by water-crowfoot Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitriche-Batrachion* vegetation and SAC site selection. Website accessed ug 2016. <http://jncc.defra.gov.uk/protectedsites/sacselection/species.asp?FeatureIntCode=H3260>
- JNCC** (2014). *Common Standards Monitoring Guidance for Rivers*. Version January 2014, Updated from March 2005. Joint Nature Conservation Committee (published online).
- Kelleher, C.** (2011). Floating river vegetation (EU Habitat code 3260) – a review of the habitat description and its distribution in Ireland. Unpublished report for National Parks & Wildlife Services. Department of Arts, Heritage and the Gaeltacht, Dublin, Ireland.
- Lockhart, N., Hodgetts, N. & Holyoak, D.** (2012) *Ireland Red List No.8: Bryophytes*. National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht, Dublin, Ireland.
- NPWS** (2014). *Site Synopsis: Slaney River Valley SAC*. Version date: 10.02.2014. National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht.
- NPWS** (2013). *The Status of EU Protected Habitats and Species in Ireland*. Habitat Assessments Volume 2. Version 1.0. Unpublished Report, National Parks & Wildlife Services. Department of Arts, Heritage and the Gaeltacht, Dublin, Ireland.
- NPWS** (2011). *Conservation Objectives: Slaney River Valley SAC 000781*. Version 1.0. National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht.
- Goodwillie and Associates** (2003). *Habitat survey of the River Slaney valley around Enniscorthy, Co Wexford*. Unpublished report for Posford Haskoning.
- Stace, C.A.** (2015). *Hybrid flora of the British Isles*. Botanical Society of Britain and Ireland, Bristol.
- Stace, C.A.** (2010). *New Flora of the British Isles*. 3<sup>rd</sup> Edition. Cambridge University Press, Cambridge
- White, J. and Doyle, G.J.** (1982). The vegetation of Ireland: a catalogue raisonné. *Journal of Life Science, Royal Dublin Society* 3: 289-368.

- WFD-UKTAG** (2014). *UKTAG River Assessment Method Macrophytes and Phytobenthos. Macrophytes (River LEAFPACS2)*. Water Framework Directive – United Kingdom Advisory Group, Scotland.
- Willby, N., Pitt, J.A. and Phillips, G.** (2012). *The ecological classification of UK rivers using aquatic macrophytes*. Report SC010080/R1 for Environment Agency, Bristol, UK.

## APPENDIX A – MACROPHYTE TRANSECT RESULTS

### Transect details

**Transect no.:** T1

**Location:** North of Enniscorthy, east of northern floodplain

**Grid Ref. (N end of transect):** S 97356 40619

### Notes

Water clarity good and aquatic macrophytes visible from water surface. Moderate flow. Substrate fine sediment. Aquatic macrophyte cover sparse and generally restricted to within 1-2 m from bank where water less than 1m in depth. *Ranunculus* cf *penicillatus* subsp. *penicillatus* is the dominant macrophyte but *Potamogeton perfoliatus* occasionally locally abundant near bank.

Bank vegetation with *Arrhenatherum elatius*, *Filipendula ulmaria*, *Heracleum sphondylium*, *Impatiens glandulifera*, *Phalaris arundinacea* and *Pteridium aquilinum*. Occasional trees such as *Alnus glutinosa*, *Crataegus monogyna*, *Fraxinus excelsior* and *Salix* spp.

### Photos

**Photo 1.1. River channel and bank (to N, from E bank)**



**Photo 1.2. Aquatic vegetation in channel (from E bank)**



### Aquatic macrophytes in channel (excludes submerged bank vegetation)

Species name	% Cover
<i>Elodea canadensis</i>	1
<i>Elodea nuttallii</i>	1
Filamentous algae	5
<i>Fontinalis antipyretica</i>	<1
<i>Potamogeton perfoliatus</i>	<1
<i>Ranunculus</i> cf <i>penicillatus</i> subsp. <i>penicillatus</i> *	3
<i>Sparganium</i> cf <i>emersum</i> *	<1

\*not flowering so not possible to confirm species

## APPENDIX A – MACROPHYTE TRANSECT RESULTS

### Transect details

**Transect no.:** T2

**Location:** Enniscorthy town centre, below of central bridge

**Grid Ref. (N end of transect):** S 97458 39902

### Notes

Water clarity good. Moderate to fast flow depending on tide. Low tide at time of survey exposing gravel banks within and at edge of channel. Substrate generally gravel.

No aquatic macrophytes recorded as gravel substrate not suitable for most species. Some *Sparganium cf emersum* in channel to the north of the transect location, below bridge.

The river edge has walls in this location, so bank vegetation confined to river side of wall in narrow strip. Species include *Phalaris arundinacea*, *Impatiens glandulifera*, *Filipendula ulmaria*, *Oenanthe crocata*, *Myosotis* sp. (not flowering) and *Lythrum salicaria*. Terrestrial vegetation also present on gravel, which is submerged at high tide. Species include *Rumex obtusifolius*, *Persicaria maculosa*, *Urtica dioica*, *Oenanthe crocata*, *Callitriche stagnalis*, *Matricaria discoidea*, *Veronica anagallis-aquatica*, *Dactylis glomerata*, *Rorippa sylvestris* and *Sinapis arvensis*.

### Photos

**Photo 1.3. River channel and bank (to S, from E bank)**



**Photo 1.4. Channel substrate (no macrophytes)**



### Aquatic macrophytes in channel (excludes submerged bank vegetation)

Species name	% Cover
Filamentous algae	1

## APPENDIX A – MACROPHYTE TRANSECT RESULTS

### Transect details

**Transect no.:** T3

**Location:** Southern edge of Enniscorthy town, below southern bridge

**Grid Ref. (N end of transect):** S 97493 39591

### Notes

Water clarity good and aquatic macrophytes visible from water surface. Moderate flow. Substrate fine sediment with large and small stones.

Aquatic macrophytes locally abundant, particularly on the eastern side of the channel but, generally restricted to within 1-2 m from bank where water less than 1m in depth. *Potamogeton perfoliatus* and *Elodea canadensis* are the dominant macrophytes with *Myriophyllum spicatum* and very occasional *Ranunculus cf penicillatus* subsp. *penicillatus*.

Bank vegetation with *Aegopodium podagraria*, *Angelica sylvestris*, *Anthriscus sylvestris*, *Arrhenatherum elatius*, *Clematis vitalba*, *Filipendula ulmaria*, *Heracleum sphondylium*, *Holcus lanatus*, *Lythrum salicaria*, *Persicaria maculosa*, *Phalaris arundinacea*, *Senecio jacobaea*, *Rumex obtusifolius*, *Tanacetum vulgare* and *Urtica dioica*. The non-native species *Impatiens glandulifera* and *Fallopia japonica* are locally abundant.

### Photos

**Photo 1.5. River channel and bank (to N, from W bank)**



**Photo 1.6. Aquatic vegetation in channel (from E bank)**



### Aquatic macrophytes in channel (excludes submerged bank vegetation)

Species name	% Cover
<i>Callitriche stagnalis</i>	<1
<i>Elodea canadensis</i>	5
Filamentous algae	15
<i>Myriophyllum spicatum</i>	3
<i>Potamogeton perfoliatus</i>	5
<i>Ranunculus cf penicillatus</i> subsp. <i>penicillatus</i> *	1

\*not flowering so not possible to confirm species

## APPENDIX A – MACROPHYTE TRANSECT RESULTS

### Transect details

**Transect no.:** T4

**Location:** South of Enniscorthy, just above junction between River Urrin and River Slaney

**Grid Ref. (N end of transect):** S 97213 38932

### Notes

Water clarity good and aquatic macrophytes visible from water surface. Moderate flow. Substrate fine sediment. Aquatic macrophyte abundant but generally restricted to within 1-2 m from bank where water less than 1m in depth. *Potamogeton perfoliatus* and *Myriophyllum spicatum* the dominant macrophytes with *Elodea nuttallii*. The rare *Potamogeton x cooperi* (hybrid between *P. perfoliatus* and *P. crispus*) was recorded in one location (S 9719 3886).

Diverse bank vegetation with *Angelica sylvatica*, *Arrhenatherum elatius*, *Caltha palustris*, *Filipendula ulmaria*, *Heracleum sphondylium*, *Impatiens glandulifera*, *Juncus effusus*, *Lamium album*, *Lythrum salicaria*, *Myosotis* sp. (not flowering), *Phalaris arundinacea*, *Ranunculus repens*, *Senecio jacobaea* and *Urtica dioica*. Occasional *Alnus glutinosa* trees.

### Photos

**Photo 1.7. River channel and bank (to E, from W bank)**



**Photo 1.8. Aquatic vegetation in channel (from W bank)**



### Aquatic macrophytes in channel (excludes submerged bank vegetation)

Species name	% Cover
<i>Alisma plantago-aquatica</i>	<1
<i>Callitriche stagnalis</i>	<1
<i>Elodea nuttallii</i>	5
Filamentous algae	20
<i>Myriophyllum spicatum</i>	10
<i>Potamogeton perfoliatus</i>	10
<i>Potamogeton x cooperi</i>	<1

## APPENDIX A – MACROPHYTE TRANSECT RESULTS

### Transect details

**Transect no.:** T5

**Location:** South of Enniscorthy, opposite willow woodland on eastern bank south of southern floodplain

**Grid Ref. (N end of transect):** S 97284 38118

### Notes

Water clarity good and aquatic macrophytes visible from water surface. Moderate flow. Substrate fine sediment. Aquatic macrophytes locally abundant on western side of channel, extending to 5m from western bank where water 1-2m in depth. *Potamogeton perfoliatus* the main macrophyte with just occasional *Callitriche stagnalis* close to the shore amongst tree roots.

Moderately diverse (tall) bank vegetation with *Angelica sylvestris*, *Arrhenatherum elatius*, *Filipendula ulmaria*, *Galium aparine*, *Impatiens glandulifera*, *Juncus effusus*, *Oenanthe crocata*, *Phalaris arundinacea*, *Rubus fruticosus* agg., *Rumex obtusifolius*, *Senecio jacobaea*, *Urtica dioica* and *Valeriana officinalis*. Occasional trees of *Alnus glutinosa* and *Acer pseudoplatanus*.

### Photos

**Photo 1.9. River channel and bank (to S, from W bank)**



**Photo 1.10. Aquatic vegetation in channel (from W bank)**



### Aquatic macrophytes in channel (excludes submerged bank vegetation)

Species name	% Cover
<i>Callitriche stagnalis</i>	<1
Filamentous algae	5
<i>Potamogeton perfoliatus</i>	25

## APPENDIX A – MACROPHYTE TRANSECT RESULTS

### Transect details

**Transect no.:** T6

**Location:** Back channel to river Slaney, east of northern floodplain

**Grid Ref. (N end of transect):** S 97471 40480

### Notes

Small back channel connected to River Slaney at northern and southern ends. Water cloudy but aquatic macrophytes visible. Substrate fine sediment. Mostly tree-lined so access to channel limited to open locations. No visible flow at time of survey. Debris located high on bankside trees show that the channel must flood over banks during winter.

Channel shaded and aquatic macrophytes patchy, tending to have higher cover in open areas. *Elodea nuttallii* the most abundant macrophyte, with occasional *Potamogeton natans*, *P. berchtoldii* (south of survey section), *Callitriche stagnalis* and *Lemna minor*. Some areas dominated by emergent vegetation such as *Sparganium* spp. (not flowering), *Phalaris arundinacea*, *Oenanthe crocata*, *Epilobium hirsutum*, *Myosotis scorpioides*, *Apium nodiflorum*, *Iris pseudacorus*, *Lythrum salicaria*, *Calystegia sepium*, *Urtica dioica*, *Rumex obtusifolius*, *Holcus lanatus* and *Caltha palustris*.

Bank vegetation dominated by trees (e.g. *Acer pseudoplatanus*, *Fraxinus excelsior*, *Crataegus monogyna*, *Salix cinerea* and *Alnus glutinosa*) with *Angelica sylvestris*, *Filipendula ulmaria* and *Impatiens glandulifera*. Epiphytes abundant on trees.

### Photos

**Photo 1.11. Back channel (from western bank) showing areas of open (left) and vegetated (right) channel**



**Photo 1.12. Section of back channel dominated by *Elodea nuttallii***



### Aquatic macrophytes in channel (excludes submerged bank vegetation)

Species name	% Cover
<i>Callitriche stagnalis</i>	<1
<i>Elodea nuttallii</i>	5
Filamentous algae	<1
<i>Lemna minor</i>	<1
<i>Potamogeton natans</i>	<1

## APPENDIX B – CALLITRICHE TRUNCATA SURVEY RESULTS

### Site details

**Site no.:** Site 1

**Location:** Opposite Brownwood castle

**Grid Ref.:** S 977 355

**Last recorded at site:** 2003 (R.N.Goodwillie)

### Notes

*Callitriche truncata* **NOT** recorded

Surveyed on falling tide, at low tide, to maximise area of exposed mud bank. Accessed from western bank and able to access mud edge. Grapnel used to sample flora: aquatic plants clearly visible on mud and shallow water (water clarity high). Edge of plant growth (where water becomes deeper) also clearly visible. Therefore no limitation due to access. *Elodea nuttallii* and filamentous alga locally abundant on mud, but also large bare areas so suitable habitat for *Callitriche truncata* present. Additional species (submerged/ partially submerged) include frequent *Callitriche stagnalis* and *Alisma plantago-aquatica*.

### Photos

**Photo 1.1. Exposed mud bank with *Elodea nuttallii* (view to S from W bank)**



**Photo 1.2. Exposed mud bank (low tide) with patches of *Callitriche stagnalis* (view to E from W bank)**



## APPENDIX B – *CALLITRICHE TRUNCATA* SURVEY RESULTS

### Site details

**Site no.:** Site 2

**Location:** West bank of River Slaney below Bormount House

**Grid Ref.:** S 976 353

**Last recorded at site:** 2003 (R.N.Goodwillie)

### Notes

*Callitriche truncata* **NOT** recorded

Surveyed on falling tide, at low tide, to maximise area of exposed mud bank. Accessed from western bank and able to access mud edge. Grapnel used to sample flora: aquatic plants clearly visible on mud and shallow water (water clarity high). Edge of plant growth (where water becomes deeper) also clearly visible. Therefore no limitation due to access. *Elodea nuttallii* and filamentous alga locally abundant on mud, but also large bare areas so suitable habitat for *Callitriche truncata* present. Additional species (submerged/ partially submerged) include frequent *Callitriche stagnalis*, *Equisetum fluviatile* and washed up fragments of *Potamogeton perfoliatus*.

**Additional species of interest:** *Callitriche brutia* subsp. *hamulata* present in dyke on western floodplain, running parallel to river and bank (also recorded here by Lady R.Fitzgerald in June 1990).

### Photos

**Photo 1.3. Exposed mud bank with *Elodea nuttallii* (view to N from W bank)**



**Photo 1.4. Edge of mud bank (low tide) with patches of *Elodea nuttallii* (view to E from W bank)**



## APPENDIX B – *CALLITRICHE TRUNCATA* SURVEY RESULTS

### Site details

<b>Site no.:</b> Site 3
<b>Location:</b> Edermine Bridge
<b>Grid Ref.:</b> S 977 345
<b>Last recorded at site:</b> 1990 (Lady R.Fitzgerald)

### Notes

*Callitriche truncata* **NOT** recorded in western or eastern inlets

**River:** Aquatic macrophytes frequent in river at this location (*Potamogeton perfoliatus*, *Myriophyllum spicatum*, *Elodea nuttallii* and filamentous alga).

**Western inlet:** Inlet narrow with exposed mud at low tide. *Elodea nuttallii*, *Callitriche truncata* and filamentous alga were the only macrophytes present.

**Eastern inlet:** Inlet narrow and fringed with *Phragmites australis* at entrance. Mud banks exposed at low tide. Mud banks close to river had no aquatic macrophytes other than filamentous alga. Further up inlet (20m to east from entrance) there were scattered patches of *Callitriche stagnalis*.

### Photos

Photo 1.5. Inlet on W bank (view to S from W bank)



Photo 1.6. Aquatic vegetation (*Callitriche stagnalis* and *Elodea nuttallii*) in W inlet (from N bank)



Photo 1.7. Inlet on E bank (view to E from bridge)



Photo 1.7. Aquatic vegetation (*Callitriche stagnalis*) in E inlet (from N bank)

