Appendix N

Aquatic Habitat Survey Results

N.1 Aquatic Habitat Survey Results

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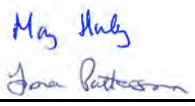
		Signature	Andrew Speer		
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Appendix N - Aquatic Habitat Survey Results

1 Description of vegetation communities

1.1 Results of the 2014 Aquatic Habitat Surveys

Aquatic habitats were surveyed for the presence of Annex I habitat types by Dr. Cilian Roden, from the 16 June 2014 to the 8 September 2014.

The results of the aquatic habitat surveys are described below with reference to the following locations: Lough Inch, Ballindooley Lough, Coolagh Lakes, the River Corrib from Tonacurragh to Menlo Castle, the River Corrib main channel, from Menlo Castle. The survey locations are shown on Figures 4.1 and 4.2 of the NIS.

The habitat classifications attributed to waterbodies described below have been incorporated into the habitat survey results figures (see Figures 8.21.1-8.21.15 and 8.24.1-8.24.15 for the full set of habitat maps provided in the EIAR). Aquatic plant species recorded in the survey sites are provided in **Table 1**.

1.1.1 Lough Inch (Site 1)

This lake, of about 25ha, lies to the west of Galway City on granite bedrock. The maximum depth recorded was less than 4m. Water transparency was good with plant growth occurring throughout the lake bottom. Shallow water contained a community *of Isoetes lacustris*, *Lobelia dortmanna* and *Littorella uniflora* as well as *Eriocaulon aquaticum*. At greater depth (2m), *Isoetes lacustris* and *Chara virgata* occurred. Below 3m, large areas of the charophyte *Nitella translucens* were found along with occasional patches of *Nitella confervacea* and *Elatine hexandra*. The presence of these species indicated that the lake corresponded with the Annex I habitats [3110] *Oligotrophic waters containing very few minerals of sandy plains* and [3130] *Oligotrophic to mesotrophic standing waters with vegetation of the Littorelleta uniflorae and/or of the Isoeto-Nanojuncetea*. This corresponded with the Fossitt (2000) classification of FL2 Oligotrophic lakes.

An unusual community *of Chara virgata, Potamogeton crispus, Potamogeton pectinatus*, and occasional *Nitella flexilis*, covered large areas in the centre of the lake. *Potamogeton crispus* and *Potamogeton pectinatus* are usually indicative of more eutrophic conditions. In addition, much fouling by algae, including *Cladophora* and diatoms, was noted. Other species noted were *Potamogeton berchtoldii*, *Juncus bulbosus*, and *Myriophyllum alterniflorum.*

The lake corresponded with two Annex I habitats [3110 and 3130] but these may have been negatively influenced by nutrient input. In addition, a number of aquatic plants known from Connemara, such as *Eriocaulon aquaticum* and *Elatine hexandra*, reach their eastern limit in this lake. The charophyte *Nitella confervacea* was recorded at Lough Inch. This species is rarely recorded in Irish lakes but this may be due its small size and, as a result, the species being under recorded.

1.1.2 Ballindooley Lough (Sites 12 to 14)

This small lake lies to the north-east of Galway City. It was surrounded by fen and reed bed vegetation with stands of *Cladium mariscus*, *Phragmites australis*, and *Schoenoplectus lacustris*. Several large drains or ditches cut into fen peat drained into the lough. A large area of marl occurred at the north-eastern end while deeper water was present at the southern end. The shore line shelved very rapidly in the southern part of the lake. The sub-littoral vegetation was dominated by charophyte algae. *Chara rudis* was exceptionally abundant from 0-3m with some other species occurring in very shallow water including *Chara aspera*, *Chara aculeolata* and

Chara curta. Flowering plants were rare, as is often the case in marl lakes, with only *Elodea canadensis* and *Utricularia* cf. *vulgaris* observed.

Most of the lake was deeper than the euphotic depth of about 4m and no plants were found. The marl area in the north-east may contain additional species but could not be examined in detail as it was too exposed for snorkelling (due to low water) and was too liquid to allow wading.

The lake was classified as the Annex I habitat 3140 *hard oligo-mesotrophic waters with benthic vegetation of charophytes* (FL4 under the Fossitt classification). The complete dominance of *Chara rudis* however, probably indicates some degree of eutrophication. The rather turbid lake water would support this conclusion.

Some of the drainage ditches (FW4 under the Fossitt classification) were also examined. The ditches appeared to be regularly dredged and contained a limited flora of *Chara virgata*, *Chara aspera*, *Chara aculeolata*, *Chara rudis*, *Potamogeton coloratus* and *Lemna trisulca*. They did not correspond to any Annex I habitat type.

In addition to the main lake, two further small water bodies were present at this site. The southernmost pool (531244 728619 ITM) was shallow with a sublittoral flora of *Elodea canadensis*, *Lemna trisulca* and *Fontinalis antipyretica*. Floating species included *Nymphaea alba*. The abundance of *Lemna* and *Elodea* indicated a eutrophic pond (Fossitt classification FL5). The smaller circular pond (531194 728778 ITM) had floating species present including *Potamogeton natans*, *Nymphaea alba* and *Sparganium natans*. Sublittoral species included abundant *Chara virgata* and *Urticularia* cf. *vulgaris*. This pond was classified as a mesotrophic water body under the Fossitt classification (FL4).

Ballindooley Lough was the site of an old record for the rare charophyte *Nitella tenuissima*. At present the species is known from the Burren, in Co. Clare and some sections of the Grand Canal (near Edenderry, Co. Offaly). Its most likely habitat would be the drainage ditches leading into the lough but it was not found there during these surveys.

1.1.3 Coolagh Lakes (Sites 6 and 7)

The open areas of deep water in the Coolagh Lakes appear to be the remnants of a large open water area shown in 19th century maps. All lakes were surrounded by dense beds of *Cladium mariscus* and *Phragmites australis*, whose spread appeared limited only by the depth of the remaining open water (>5m). As the lake bed sloped rapidly there was comparatively little ground for aquatic macrophytes. Like Ballindooley Lough, the Coolagh Lakes was a calcareous site with large areas of fen peat and no outcropping rock. In both lakes *Chara hispida* and *Chara rudis* were very abundant from the surface to 4m depth.

The upper lake contained some flowering plants including *Hippuris vulgaris*, *Myriophyllum spicatum*, *Nuphar lutea* and *Elodea canadensis* (which grew at the base of the euphotic zone at about 4m, as did some *Lemna trisulca*). However, *Chara rudis* or *Chara hispida* dominated most of the euphotic zone.

The lower lake also contained large stands of *Chara hispida* and *Carex rudis*, but flowering plants were more abundant with *Lemna trisulca* forming a zone at the base of the euphotic zone (4m) and *Elodea canadensis* intermixed with the *Chara* species. Other species included *Potamogeton lucens*, *Sparganium* sp., *Myriophyllum spicatum* and *Urticularia* cf. *vulgaris*. Two other species of charophyte, *Chara contraria* and *Chara vulgaris* occurred in small quantities.

The lakes correspond to the Annex I habitat [3140] *Hard oligo- mesotrophic waters with benthic vegetation of charophytes*, and the FL3 Fossitt classification. The lower lake however, was considered the borderline eutrophic type under the Fossitt classification (FL5), due to the increased presence of *Elodea canadensis* and *Lemna trisulca*. A strong case could be made that the area has

changed greatly due to eutrophication and was not an exceptional example of the habitat type. The presence of Zebra mussels *Dreissena polymorpha* also degrades the habitat value.

The channel linking the Coolagh Lakes to the main channel of the River Corrib was thought to probably be maintained by cutting. It was fringed by very dense stands of *Phragmites australis* and *Cladium mariscus*. It was up to 1m deep with *Nuphar lutea*, *Menyanthes trifoliata*, *Elodea canadensis, Chara rudis* and *Lemna trisulca* growing in the channel. *Ranunculus lingua* was conspicuous in the reed swamp on the channel edge. This habitat was classified as a drainage ditch under the Fossitt classification (FW4).

1.1.4 River Corrib from Tonacurragh to Menlo Castle (Sites 2, 3 and 4)

This section of the river had a low flow rate (in summer) and had characteristics resembling a hard water lake. Vegetation was determined by sampling transects along the river. The vegetation was dominated by charophyte algae in many places, especially *Chara rudis.*

In the upper river near the junction of the Friar's Cut, the shore included backwaters dominated by reed swamp and open water with *Chara curta*, *Chara virgate annulata* and cyanobacterial crust on stones, as on the shore of Lough Corrib and other calcareous lakes. In deeper water (1m) *Chara rudis* was dominant with emergent vegetation including *Schoenoplectus lacustris* and *Phragmites australis*. *Chara rudis* extended to 2m depth along with *Zannichella palustris*, *Potamogeton lucens*, a little *Potamogeton crispus* and *Myriophyllum spicatum,* while *Chara globularis* extended to 3m along with some *Nuphar lutea* and abundant Zebra mussels. At this depth a white, shelly marl replaces the dark peat and mud of shallower water. In the main channel the river shelves very steeply and *Potamogeton perfoliatus* occurred.

Midway between the Friars cut and Menlo Pier the river was divided by a long narrow bank vegetated with swamp (527715 728520 ITM) with species present including *Eleocharis palustris, Hippuris vulgaris, Lythrum salicaria, Ranunculus flammula, Valeriana officinalis, Iris pseudacorus, Schoenoplecutus lacustris, Sparganium* sp., *Menyanthes trifoliata, Calystegia sepium* and *Myosotis laxa*[1].

The shallower western channel, to a depth of 2m, contained reed swamp followed by *Chara virgata annulata*, *Lemna trisulca*, *Elodea canadensis* and *Nuphar lutea* in 1m depth water, and *Potamogeton perfoliatus* beds at 2m. In places, bare areas of mud were colonized *by Nitella opaca*. The main channel shelved very steeply with *Potamogeton perfoliatus*, *Lemna trisulca*, and *Elodea canadensis*, followed by bare ground with Zebra mussels.

On the east bank *Chara rudis* was dominant with some *Potamogeton berchtoldii*, *Lemna trisulca* and *Elodea canadensis*.

Below Menlo Pier the river narrowed and deepened with little vegetation other than *Potamogeton perfoliatus* and *Potamogeton natans* along with some *Chara rudis* in shallow water close to the bank.

The depth of the river varies greatly, with many shallow inshore areas, but the main channel was cut into white marl which exceeded 8m depth in places. Vegetation was largely confined to water less than 4m, but Zebra mussels occurred deeper than this. A variety of flowering plants occurred, especially pond weeds (*Potamogeton* sp.). Nearly all shallow areas of any extent were occupied by *Schoenoplectus* and *Phragmites* reed swamp.

As the area is technically a river, it was classified as a depositing lowland river under the Fossitt classification (FW2) and does not correspond with any Annex I habitat type. Parts at least might equally be viewed as a southern extension of Lough Corrib, in which case it would be classified as the Annex I habitat [3140] *Hard oligo- mesotrophic waters with benthic vegetation of charophytes*

[1] Note that these species are provided here for information as they were associated with the island, and not aquatic, habitat.

and lake type FL4 in the Fossitt classification.

1.1.5 River Corrib main channel, from Menlo Castle to the Salmon Weir (Sites 5 and 9)

In this section the river flow was stronger and river vegetation largely confined to shallows along the banks. Vegetation was only found in depths of <2 m and as largely either reed swamp of *Phragmites australis* or *Equisetum fluviatile*, with some stands of *Potamogeton natans* and *Carex rostrata. Chara rudis* and some *Chara virgata* were common in the shallow sublittoral. Species composition was similar but less diverse than the upstream section and the main channel was classified as a depositing lowland river (FW2 under the Fossitt classification), and did not correspond with any Annex I habitat type.

1.1.6 Backwater on the east side of Jordan's Island (Site 8)

This section consisted of small pools and channels cut through extensive *Phragmites australis*, *Schoenoplectus lacustris* and *Cladium mariscus* reed swamp. The area contained a diverse flora, especially of charophytes, but like all habitats surveyed showed signs of eutrophication. Species present include *Chara aspera*, *Chara contraria*, *Chara curta*, *Chara globularis*, *Chara rudis*, *Chara vulgaris* and *Chara virgata*. Other aquatic species included *Potamogeton pectinatus*, *Potamogeton perfoliatus*, *Potamogeton lucens*, *Potamogeton natans*, *Myriophyllum spicatum*, *Elodea canadensis*, *Berula erecta*, *Lemna trisulca*, *Nuphar lutea* and *Oenanthe aquatica*. Blanket weed or *Cladophora* sp. was common, suggesting eutrophication. As the original channel is now almost completely filled with reed swamp the remaining open water might be best classified as a series of meso or eutrophic pools (FL4/5 under the Fossitt classification) linked by channels or drainage ditches (FW4 under the Fossitt classification).

1.1.7 River Corrib and Canals south of the Salmon Weir (Site 10)

There was aquatic vegetation similar to the river section above the weir but poorer, and vegetated areas were classified as canal under the Fossitt classification (FW3) as it is largely confined to the Eglington Canal and old mill races. Species included *Potamogeton perfoliatus*, *Potamogeton natans*, *Potamogeton pusilus*[2], *Elodea Canadensis, Myriophyllum spicatum, Chara rudis* and *Ranunculus* sp. The main river channel was tidal below the weirs and classified as estuary (MW4), though the exact boundary between river and estuary was not defined in this study.

1.1.8 Terryland River (Site 11)

The river appeared very eutrophic and had a limited flora present including *Potamogeton natans*, *Callitriche* sp., *Alisma plantago aquatia*, *Chara hispida/rudis*, *Myriophyllum spicatum*, *Sparganium* sp. and *Elodea canadensis*. Large areas of bare mud and extensive development of blanket weed, *Cladophora* sp. indicate significant eutrophication. The Terryland River was classified as a depositing lowland river under the Fossitt classification (FW2)

A summary table of the species recorded is shown below in **Table 1**.

[2] Species ID not confirmed under microscope.

Table 1- Occurrence of aquatic species in 2014

	Survey Locations[3]													
Species[4]	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**
Alisma plantago-aquatica	-	-	-	-	-	-	-	P	-	-	P	-	-	-
Berula erecta	-	-	-	-	-	-	-	P	-	-	-	-	-	-
Carex rostrata	-	-	-	-	-	-	-	-	P	-	-	-	-	-
Callitriche sp.	-	P	-	-	-	-	-	-	-	-	P	-	-	-
Chara aculeolata	-	-	-	-	-	-	-	-	-	-	-	P	-	-
Chara aspera	-	-	-	-	-	-	-	P	-	-	-	P	-	-
Chara contraria	-	-	-	-	-	-	P	P	-	-	-	-	-	-
Chara curta	-	P	-	-	-	-	-	P	-	-	-	P	-	-
Chara globularis	-	P	-	-	-	-	-	P	-	-	-	-	-	-
Chara rudis	-	P	-	P	P	P	P	P	P	P	P	P	-	-
Chara virgata	P	-	-	-	-	-	-	P	-	-	-	P	-	P
Chara virgata annulata	-	P	P	-	-	-	-	-	P	-	-	-	-	-
Chara vulgaris	-	-	-	-	-	-	P	P	-	-	-	-	-	-
Cladium mariscus	-	-	-	-	-	P	P	P	-	-	-	P	-	P
Cladophora sp.	P	-	-	-	-	P	P	P	-	-	P	-	-	-
Equisetum fluviatile	-	P	-	-	P	P	P	P	P	-	-	-	-	-
Elatine hexandra	P	-	-	-	-	-	-	-	-	-	-	-	-	-
Elodea canadensis	-	P	P	P	-	P	P	P	-	P	P	P	P	-
Eriocaulon aquaticum	P	-	-	-	-	-	-	-	-	-	-	-	-	-
Fontinalis antipyretica	-	-	-	-	-	-	-	-	-	-	-	-	P	-
Hippuris vulgaris	-	-	P	-	-	P	-	-	-	-	-	-	-	-
Isoetes lacustris	P	-	-	-	-	-	-	-	-	-	-	-	-	-
Juncus bulbosus	P	-	-	-	-	-	-	-	-	-	-	-	-	-
Lemna trisulca	-	--	P	P	-	P	P	P	-	-	-	P	P	-
Littorella uniflora	P	-	-	-	-	-	-	-	-	-	-	-	-	-
Lobelia dortmanna	P	-	-	-	-	-	-	-	-	-	-	-	-	-
Menyanthes trifoliata	-	-	-	-	-	-	P	-	-	-	-	-	-	-
Myriophyllum alterniflorum	P	-	-	-	-	-	-	-	-	-	-	-	-	-
Myriophyllum spicatum	-	P	-	-	-	P	P	P	-	P	P	-	-	-
Nitella confervacea	P	-	-	-	-	-	-	-	-	-	-	-	-	-
Nitella flexilis	P	-	-	-	-	-	-	-	-	-	-	-	-	-
Nitella opaca	-	-	P	-	-	-	-	-	-	-	-	-	-	-
Nitella translucens	P	-	-	-	-	-	-	-	-	-	-	-	-	-

[3] Site 1 Lough Inch, Site 2 River Corrib (Friar's Cut area), Site 3 River Corrib (Friar's Cut to Menlough Pier), Site 4 River Corrib (Menlough Pier to Menlo Castle), Site 5 River Corrib (Menlo Castle to Coolagh Lakes), Site 6 Coolagh Lakes (Upper Lake), Site 7 Coolagh Lakes (Lower Lake), Site 8 River Corrib (Backwater on east side of Jordan's Island), Site 9 River Corrib (Jordan's Island to the Salmon Weir), Site 10 River Corrib and Canals below the Salmon Weir, Site 11 Terryland River, Site 12 Ballindooley Lough (Main Lake), Site 13 Ballindooley Lough (southern lake), Site 14 Ballindooley Lough (western lake)

[4] P = present, (-) = absent

Nuphar lutea	-	P	P	-	-	P	P	P	-	-	-	-	-	-
	Survey Locations[2]													
Species[3]	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**
Nymphaea alba	-	-	-	-	-	-	-	-	-	-	-	-	P	P
Oenanthe aquatica	-	P	-	-	-	-	-	P	-	-	-	-	-	-
Phragmites australis	-	P	P	P	P	P	P	P	P	P	P	P	P	P
Potamogeton berchtoldii	P	-	-	P	-	-	-	-	-	-	-	-	-	-
Potamogeton coloratus	-	-	-	-	-	-	-	-	-	-	-	P	-	-
Potamogeton crispus	P	P	-	-	-	-	-	-	-	-	-	-	-	-
Potamogeton lucens	-	P	-	-	-	-	P	P	P	-	-	-	-	-
Potamogeton natans	-	-	-	-	P	-	-	P	P	P	P	P	-	P
Potamogeton pectinatus	P	-	-	-	-	-	-	P	-	-	-	-	-	-
Potamogeton perfoliatus	-	P	P	-	P	-	P	P	-	P	-	-	-	-
Ranunculus lingua	-	-	-	-	-	-	P	-	-	-	-	-	-	-
Ranunculus sp.	-	-	-	-	-	-	-	-	-	P	-	-	-	-
Schoenoplectus lacustris	-	P	-	P	P	P	P	P	P	-	-	P	-	P
Sparganium sp.	-	-	-	-	-	-	P	-	-	-	P	-	-	-
Sparganium natans	-	-	-	-	-	-	-	-	-	-	-	P	-	P
Typha latifolia	-	P	-	-	-	-	-	P	P	-	-	-	-	-
Urticularia cf. *vulgaris*	-	-	-	-	-	-	P	-	-	-	-	P	-	P
Zannichella palustris	-	P	-	-	-	-	-	-	-	-	-	-	-	-

1.2 Results of the 2023 aquatic habitat verification surveys

1.2.1 River Corrib from junction with Friars Cut to the Salmon Weir

This is a broad river, mostly over 4m deep with a maximum of 6.5m detected during the survey. It varies in width from 60m to 150m and it is largely fringed by swamp which is a few metres up to 30m wide. There are a few swamp islands upstream and downstream of Menlo which are cut off from the edge by deep channels and there are also a few rocky reefs and islets. Under the water the aquatic vegetation is limited to the margins and the vicinity of islands due to a drop off into deeper water. Generally vegetation descended to about 2.5m but sometimes deeper.

The swamp is quite variable in width, usually wider when the river width was wider and at Menlo it has infilled a former channel of the River Corrib. The predominant species is *Phragmites australis* and in places this is more or less the only species. More usually there is a mixture with *Schoenoplectus lacustris, Typha latifolia, Equisetum fluviatile* and *Sparganium erectum*. Quite frequently the *Schoenoplectus* becomes most frequent, or even the main species, at the deep-water edge. A few patches of *Carex rostrata, Menyanthes trifoliata* and *Eleocharis palustris* were seen but these may be more widespread on the landward side of the reeds which was not investigated during the survey. There are some areas where the swamp margin is intermittent or absent, particularly on the west bank upstream and downstream of the existing N6 bridge and on both sides near Menlo Castle. Often this is because the bottom shelves steeply and/or trees overhang the edge of the river.

Quite frequently there is a band of *Nuphar lutea* along the deep-water edge of the swamp, both within the swamp where it is more open and extending out beyond this. Along most of the river sides there are communities of submerged plants forming a band along the deep-water edge of the swamp. Depending on the steepness of the drop-off into deep water this can vary from intermittent patches of plants to a fairly dense community around 5m wide. The composition is somewhat variable with no clear pattern or zonation. **Table 2** gives the percentage frequency of each species in sample points along the river and shows that the most consistant species were *Elodea canadensis, Lemna trisulca, Myriophyllum spicatum, Chara virgata, Ceratophyllum demersum, Utricularia vulgaris* agg. and *Potamogeton perfoliatus*. Mostly the vascular plants dominated the community but there are a few areas where charophytes become dominant, mainly in areas where there is some shelter from the full force of the current such is in embayments, the lee of islands and around the mouth of the River Corrib where it joins the main flow in the Friars Cut. This is discussed in more detail later in the report (see section 4.3.2). Filamentous algae was frequently present among the plants but only rarely was the dominant vegetation.

Although, the shallows are very largely occupied by swamp where the river edges are not overshaded by trees, there are a few places where there are unshaded gaps in the swamp. These open shallows are quite varied and provide a niche for several species not found in the deeper water, including *Littorella uniflora, Myriophyllum alterniflorum, Chara curta* and *Baldellia ranunculoides*. Examples of this niche occur on the right bank upstream of Menlo where there is only a thin band of *Carex rostrata* at the edge, the bay on the right bank at the corner south of Menlo, on the left bank at Menlo Castle where the shore is protected by boulders and there is possibly disturbance by boats mooring and the left bank 500m downstream of Menlo Castle where there are open patches among the reeds. It is likely that livestock access to the shore contributes to the opening up of the swamp in these areas.

1.2.2 Jordan's Island channel

An oxbow channel runs along the eastern side of Jordan's Island. Much of this is 10-15m wide but in one area it reaches 40m wide. Although nearly blocked by swamp in one place, elsewhere there is a clear channel right through. Nevertheless, flow is probably quite limited in most conditions. In the lower part the water is quite turbid (in contrast with everywhere else in the survey area) and this

cloudiness is evidently connected to a stream entering on the left bank. The source of this needs further investigation.

The vegetation of this channel is broadly similar to the communities in the main river. Being shallower and slower-moving, much of the channel is vegetated although the mid-line is often unvegetated and there is a deep unvegetated pool in the widest part. The composition of the swamp margin is quite similar to the main river although *Menyanthes trifoliata* is more prominent on the island side of the channel. There is also an area of open shallows on the left bank kept open by grazing access and this contains shallow water species as discussed above.

Nuphar patches are frequent, sometimes mixed with *Potamogeton natans*. The submerged communities are similar to the main river (see **Table 2**) but the quieter conditions favour more frequent patches of charophytes and there is significantly less Lemna trisulca.

Table 2 - Percentage occurrence of aquatic species in sample points taken in 2023

	All	Jordan's Island Channel	Main river
n =	130	31	99
Elodea canadensis	48	55	46
Lemna trisulca	45	19	53
Myriophyllum spicatum	38	42	36
Chara virgata	33	19	37
Nuphar lutea	27	29	26
Ceratophyllum demersum	25	10	29
Utricularia vulgaris agg.	24	3	30
Potamogeton perfoliatus	24	13	27
Chara rudis	22	32	19
Cladophora	14	10	15
Spirogyra	13	0	17
Chara curta	8	10	7
Potamogeton lucens	8	10	7
Fontinalis antipyretica	5	0	6
Nitellopsis obtusa	3	0	4
Potamogeton berchtoldii	3	3	3
Potamogeton natans	3	10	1
Potamogeton pusillus	3	6	2
Myriophyllum alterniflorum	3	6	2
Littorella uniflora	3	6	2
Chara contraria	2	10	0
Hippuris vulgaris	2	0	2
Stuckenia pectinata	2	0	2
Chara globularis	2	0	2
Potamogeton x angustifolius	1	0	1
Lemna minor	1	0	1
Lemna minuta	1	0	1
Sponge	1	3	0
Chara vulgaris	1	0	1

Potamogeton x nitens	Only in Convent R
Ranunculus penicillatus	Only Convent R, Middle R, lower R Corrib
Nitella flexilis agg.	Only in Middle R

1.2.3 River Corrib downstream of the Salmon Weir

This part of the river is inaccessible due to high retaining walls. The river was also high and the flow very lively. It was therefore investigated by looking down from above. As far as could be seen among the turbulence, the river was about 1.5m deep and there was some vegetation of mosses and *Ranunculus penicillatus* but it was difficult to see the extent of these. There were also well developed moss communities on the bases of the retaining walls.

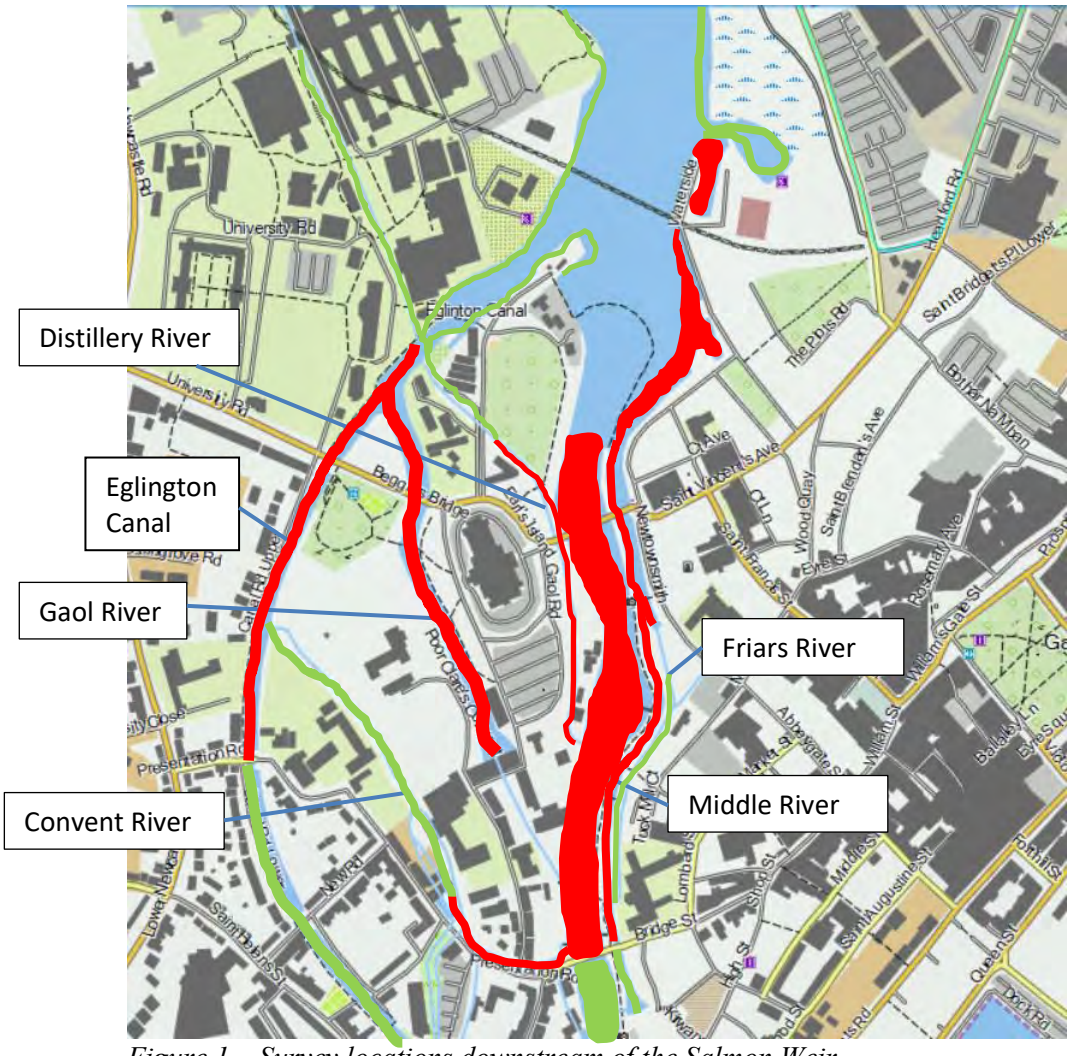

Figure 1 – Survey locations downstream of the Salmon Weir

1.2.4 Friars River

The Friars River branches off the left side of the River Corrib, just above the Salmon Weir. It has moderate flow and at its upstream end it is 12m wide and 2m deep. It is confined by concrete walls and vegetation is patchy. There is some *Nitellopsis obtusa* and *Chara rudis* in the approaches but this gives way to *Elodea canadensis* patches with some *Potamogeton natans*. There is also some *Ranunculus penicillatus* where the river is shallower and faster.

Shortly the river splits with the bulk of the flow flowing to the right into what is called the Middle River. The smaller left fork, which is the Friars River soon disappears into an underground culvert. It reappears temporarily about 100m downstream but this section was not investigated.

1.2.5 Middle River

This is a continuation of the main flow of the Friars River and has moderate flow. It runs parallel but several metres above the left bank of the River Corrib and it was investigated downstream to Bridge Street. It seems once to have been used as a canal with a lock at the top and another two-thirds of the way down the stretch investigated. In the stretch between the locks the river is usually about 3m deep and contained by concrete walls. Parts are overshaded by trees. In the water there is a mixture of unvegetated areas and areas dominated by *Elodea canadensis*. Other aquatics present include *Ceratophyllum demersum, Nitella flexilis* agg. (the only location where this was seen of the survey), *Potamogeton perfoliatus* and *Utricularia vulgaris* agg.

Below the second lock, it is shallower (1.5 metres) and has abundant beds of *Ranunculus penicillatus* and *Elodea canadensis* with locally abundant patches of *Chara rudis*, the latter being most frequent in part nearest to Bridge Street

1.2.6 Distillery River

This is a small river which comes off the right bank of the River Corrib south of the existing N6 bridge, runs through the University of Galway campus and is culverted underneath the Eglington Canal. It rejoins the River Corrib below Galway Cathedral, Only the section downstream of the Eglington Canal was investigated but it is inaccessible here and was mainly viewed from above.

Much of this river is shaded by trees. It is concrete lined and shallow to 50cm deep. It has moderate flow and the vegetation was mainly mosses and algae.

1.2.7 Gaol River

This is essentially a dead-end branch of the Eglington Canal, running beside Galway Cathedral. The flow seems to be negligible and some parts are more or less filled by *Phragmites australis* swamp with local patches of *Typha latifolia* and *Sparganium erectum*, particularly in the stretch downstream of University Road. There are some overhanging trees locally but much of it is unshaded. The margins are mainly retaining walls but there are some patches of wetland fringe of *Phalaris arundinacea* and *Calystegia sepium* with some *Epilobium hirsutum* and *Angelica sylvestris*.

Where the swamp is absent, the shallows are mostly bare cobbles, boulders and silt with Elodea canadensis becoming dominant beyond 50cm depth. Lemna trisulca is locally frequent and there are some rafts of algae (*Cladophora*). There are also a few patches of *Chara rudis* and *Chara virgata*.

1.2.8 Convent River

This is a branches off the Eglington Canal and connects through to the River Corrib south of Galway Cathedral. The upper part is not publicly accessible but from aerial photographs it appears to be shallow and well vegetated. The lower end runs alongside Presentation Road and this part was investigated. Here the river is one metre deep with a gravelly bottom and there is abundant *Myriophyllum spicatum* and *Fontinalis antipyretica* with patches of *Elodea canadensis, Potamogeton x nitens* and *Ranunculus penicillatus*. There is some fringing swamp of *Sparganium erectum, Menyanthes trifoliata* and *Phalaris arundinacea* but upstream the river is contained by retaining walls and the swamp is absent. A small stream emerges from a mill adjacent to the river and also contains *Ranunculus penicillatus* and some patches of *Potamogeton x nitens*.

1.2.9 Eglington Canal

This canal was investigated downstream as far as Presentation Road. The flow is negligible and it is contained between retaining walls on both sides. It is generally about 3m deep, although it shallows to

1.5m for a stretch downstream of the junction with the Convent River. Vegetation seems to be absent in the middle but as it shallows towards the edges (2m deep) there is locally abundant *Myriophyllum spicatum* and *Elodea canadensis*. There are also local patches of *Chara rudis*. Also present are *Fontinalis antipyretica, Nitellopsis obtusa, Ceratophyllum demersum, Potamogeton perfoliatus* and *Lemna trisulca*.

2 Discussion

2.1 Changes in recent decades

Mooney and O'Connell (1990) mapped the vegetation communities around the southern end of Lough Corrib and the River Corrib, including a significant part of the survey area. These were the area upstream of Menlo and an area around Jordan's Island. Details of the aquatic vegetation can be found on maps of the main communities, community descriptions and 22 relevés.

They discerned six aquatic communities, although three were not seen within the area of this survey:

- A *Nuphar lutea* community with an understorey particularly of *Chara rudis* and *Potamogeton lucens* (10 relevés)
- A *Chara* dominated community, although the species of *Chara* present differed in each of the locations(3 relevés)
- A *Potamogeton perfoliatus* community, only seen at Menlo (1 relevé)
- A *Hippuris vulgaris* community in Lough Corrib and Menlo Creek. Outside the survey area (4 relevés)
- A *Nymphaea alba* community, only at the upper end of the River Corrib, not in the survey area (2 relevés)
- A *Zannichellia palustris/Potamogeton berchtoldii* community in Menlo Creek, outside the survey area (2 relevés)

Of these, the *Nuphar lutea* and *Hippuris vulgaris* communities are the only one with sufficient frequency to be mapped and what is striking is the apparent extreme rarity of aquatic communities, both in the river and in the southern end of Lough Corrib. This conflicts with knowledge from other sources, at least in relation to Lough Corrib, and suggests that the aquatic communities were not well recorded in this study. Nevertheless, while it might be easy to miss submerged communities, water lily communities would be more obvious. It may therefore be significant that only one water lily patch was mapped within the area of the current survey (in the channel behind Jordan's Island). Given the current frequency of *Nuphar lutea*, it seems likely that there has been a significant increase in this species within the last 30 years.

The aquatic species recorded in the Mooney and O'Connell (1990) relevés are listed in **Table 3** below.

Table 3 - Frequency of aquatic species recorded in 22 relevés in aquatic communities in Mooney and O'Connell (1990)

	% presence in 22 relevés
Nuphar lutea	50
Chara rudis	50
Elodea canadensis	41
Hippuris vulgaris	28
Lemna minor	18
Potamogeton lucens	14
Utricularia minor	14
Potamogeton natans	14

Chara vulgaris	14
Myriophyllum spicatum	14
Nymphaea alba	9
Zannichellia palustris	9
Potamogeton berchtoldii	9
Chara globularis	9
Chara virgata	9
Chara aspera	9
Lemna trisulca	9
Stuckenia (Potamogeton) pectinata	6
Potamogeton perfoliatus	5
Chara contraria	5
Chara hispida	5

The species list has much in common with the species list from the current survey, especially since most of the species not refound were previously recorded from outside the current survey area. However, although it seems likely that the submerged aquatics were under-recorded by Mooney and O'Connell, there seems to be some distinct shifts in abundance. In particular:

- A distinct decrease in the relative abundance of *Chara* spp., particularly *Chara rudis*
- An large increase in the frequency of *Lemna trisulca*
- An increase in the frequency of *Myriophyllum spicatum* and *Ceratophyllum demersum*

Such changes along with the possible increase in the abundance of *Nuphar lutea* are consistent with the changes that occur in marl lakes that are being impacted by nutrient enrichment (Roden et al. 2020). Such changes are known to be occurring in Lough Corrib (NPWS, 2017) and it is, therefore, no surprise that similar changes seem to be also occurring in the River Corrib.

It was considered by the surveyors in 2014 that most of the habitats showed signs of eutrophication, including:

- Abundant *Cladophora* growth
- A shallow euphotic or vegetation depth in Ballindooley Lough, Coolagh Lakes and the River Corrib (4m in these lakes vs 8-10m in unpolluted hard water lakes)
- The dominance of *Chara rudis* at all hard water sites. In unpolluted lakes a more diverse charophyte flora would be expected. Abundant *Lemna trisulca* is also indicative of eutrophication
- The presence of *Potamogeton crispus* and *Potamogeton pectinatus* in Lough Inch
- The absence of the enrichment sensitive *Nitella tenuissima* from Ballindooley Lough, and
- The presence of very dense and extensive reed swamp, not usually encountered in unpolluted limestone water bodies in western Ireland

This widespread nutrient enrichment reduces the quality of the aquatic Annex I habitats but they may recover in the event of nutrient reduction.

Stewart (2004) suggested that the presence of five or more charophyte species indicated a site of conservation value in the UK. An equivalent Irish classification has not been proposed but given that at least seven charophyte species have been recorded in sites such as Jordan's Island and Ballindooley, they could be considered to have noteworthy charophyte floras.

2.2 Notable species

The river contains a high diversity of aquatic species, with 30 species of vascular plant and charophyte recorded during the 2023 verification survey. This includes eight charophyte species and

seven pondweeds (*Potamogeton* spp.). A number of these are local and/or decreasing in Ireland and are indicators of good aquatic habitat but only one is particularly rare.

Starry Stonewort *Nitellopsis obtusa* is otherwise known in Ireland only from Lough Derg and Lough Ree together with the River Shannon between (Baars et al. 2023). It was first recorded here in 2009 and its appearance is part of a natural spread from southern Britain where it is also increasing in range. The reasons for this spread are not known with certainty but may be linked to better fruiting as a result of climate change. It has been increasing in abundance in the Shannon system since its first discovery and is now locally abundant in some areas.

The appearance of this species in the River Corrib is a new discovery on this survey (see **Figure 2**). Here it was seen in small quantity in a few locations along the river around Menlo but occurs in considerable quantity just above the Salmon Weir. It also occurs here and there along the Eglington Canal. As Starry Stonewort is normally a lake species, the author suspects that these occurrences could be outliers of a colony in Lough Corrib; it has not yet been recorded there but this could be due to lack of survey. The occurrences seen would be consistent with material being carried downstream by the currents, possibly aided by boat movements (e.g. on anchors). Even if this theory is not correct, the fact that it is increasing in Ireland means that it is not recommended that the species requires particular conservation attention beyond general habitat protection measures.

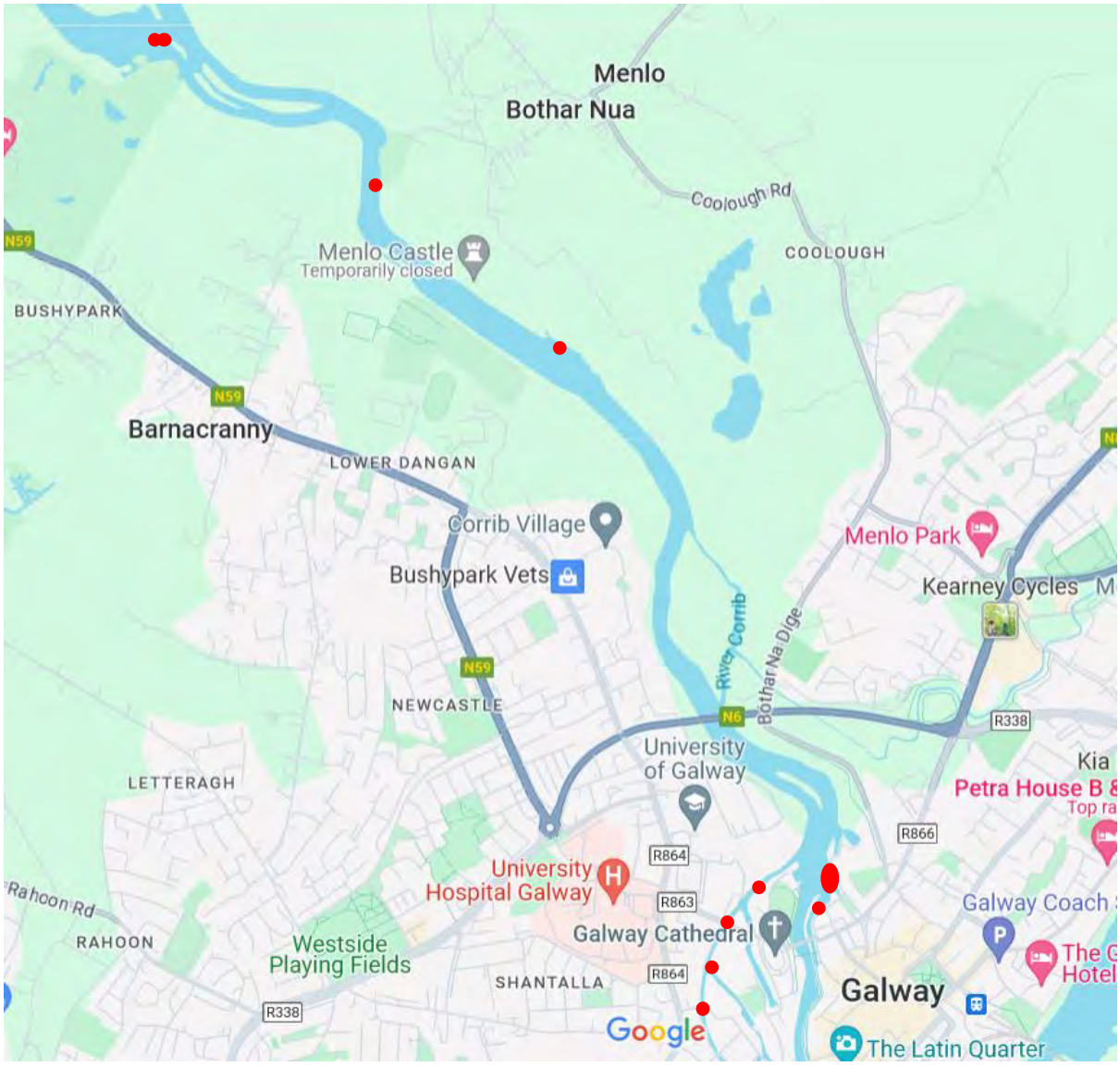

Figure 2 - Locations of Starry Stonewort Nitellopsis obtusa in the survey area in 2023

2.3 European protected habitats

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

The presence of this habitat type in the survey area depends on how it is defined. In some parts of Europe it is interpreted as covering only rivers where water crowfoots *Ranunculus* species are a significant component of the vegetation. Such communities are present but rare in the survey area (see **Figure 3**): they occur in the lower part of the Convent River, connecting between the Eglington Canal and the main River Corrib beside Presentation Road. Also in some parts of the Middle River beside the left bank of the River Corrib. *Ranunculus* communities also occur also occur in the main River Corrib below the Salmon Weir but this part of the river is inaccessible and the flow at the time of survey was too dynamic to discern what was growing in the river. This made it difficult to assess the extent of the *Ranunculus* beds. Dr. Cilian Roden originally concluded that the upper part of the River Corrib main channel, near the junction of Friar's Cut, did not correspond with the Annex I habitat type [3260] *Water courses of plain to montane levels with the Ranunculion fluitantis and Callitricho-Batrachion vegetation* due to the absence of *Ranunculus* species and scarcity of *Callitriche* sp.. However, in Ireland the interpretation of this community is taken much wider to include most types of river vegetation. This is expressed in the statement of conservation objectives for the Lough Corrib SAC (NPWS 2017): "The description of 3260 is broad, from upland bryophyte/macroalgal dominated stretches, to lowland depositing rivers with pondweeds and starworts. Selection of SACs for the habitat used this broad interpretation." National Parks & Wildlife Service (NPWS) in their Article 17 monitoring reporting[5] notes that '*there is to date no satisfactory definition of the habitat and its sub-types or their distribution in Ireland'*. Taking a precautionary approach, and considering the broad interpretation of the 3260 Annex I habitat type, all of the aquatic vegetation communities found along the vegetated parts of the River Corrib and connecting channels are covered by this wider interpretation of 3260 and the extent is therefore shown in **Figures 17.1-17.5** of the NIS and **Figures 8.22.1-8.22.15** of the EIAR.

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[5] NPWS (2013) *The Status of EU Protected Habitats and Species in Ireland. Habitat Assessments Volume 2*. Version 1.1. Unpublished Report, National Parks & Wildlife Services. Department of Arts, Heritage and the Gaeltacht, Dublin, Ireland.

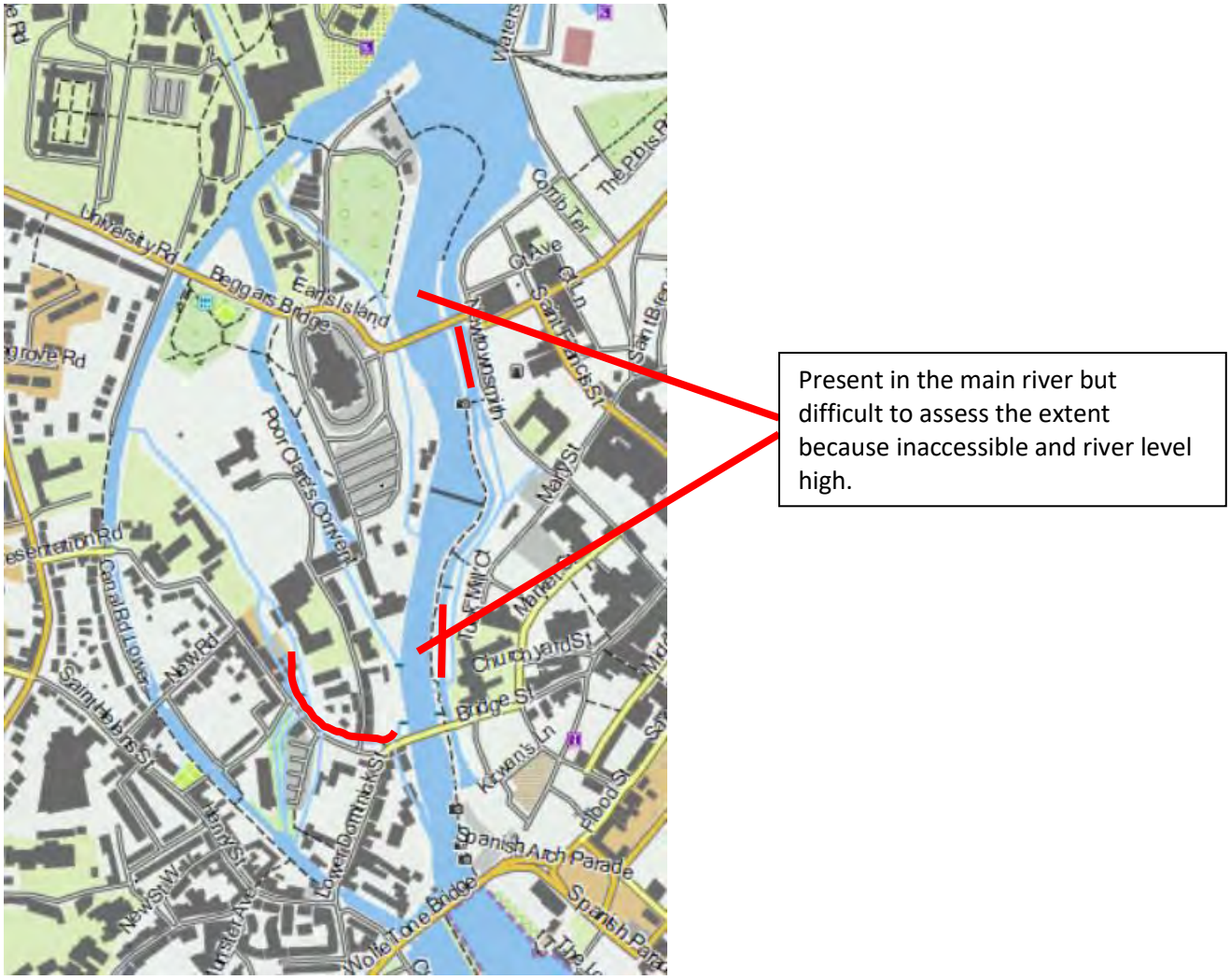

Figure 3 - Occurrence of water crowfoot (Ranunculus) communities in the survey area in 2023.

2.3.2 Hard oligo-mesotrophic waters with benthic vegetation of *Chara* spp. [3140]

This habitat type is characterised by communities dominated by *Chara* spp. and these communities occur in several places along the River Corrib. Charophytes also occur scattered among other vegetation quite frequently along the river. The main species present are *Chara virgata* and *Chara rudis* but also recorded in smaller amounts were *Chara globularis, Chara curta, Chara contraria* and *Chara vulgaris*.

Figure 4 below indicates the areas with frequent to locally dominant charophytes encountered in the survey. It is noticeable that most of the locations where *Chara* communities are locally dominant are where there is some protection from the main flow of the river due to islands, embayments or lower-flow channels. The latter includes the channel around the east side of Jordan's Island and in the River Corrib above the junction with the Friar's Cut (which takes the more major flow from Lough Corrib).

Although the 3140 habitat type is intended to be a standing water type, the river is closely linked to Lough Corrib upstream. The occurrence of the *Chara* communities, although limited, should therefore be considered as outlying parts of Lough Corrib ecology. As discussed above in section 4.1 there is some indication that there has been some reduction in the extent of charophytes in the over the last 30 years and this is probably linked to changes in the lake as a result of nutrient enrichment.

Figure 4 - Distribution of Chara communities; red dots indicated Chara spp. locally dominant, orange dots indicate Chara species frequent in 2023

2.3.3. Oligotrophic to mesotrophic standing waters with vegetation of the *Littorelletea uniflorae* and/or *Isoeto-Nanojuncetea* [3130]

This habitat is another that is essentially a standing water habitat type. It is characterised by communities dominated by *Littorella uniflora* and other stiff-leaved rosette species ("Isoetids"). There are a few small patches of *Littorella uniflora* in the shallows on the north-eastern side of the river downstream of Menlo Castle and on the east side of the channel behind Jordan's Island (see **Figure 5).** The extent of this is strongly limited by the swamp vegetation which dominates the majority of the edges of the river. At these points livestock have access to the shore which creates openings in the shallows suitable for this species. However, despite the presence of Littorella communities, it is doubtful that these small fragments warrant classification as this habitat type as a whole.

From the 2014 survey results, the vegetation of Lough Inch was very different from all other survey sites and was classified as containing the Annex I habitat types [3110] and [3130]; it also contained

plant communities A22, A23, and A24[6] of Rodwell (1995). The other survey sites showed similarities in their relative vegetation communities probably because of a similar calcareous aquatic habitat. However, the commonest, and in places most abundant, species included the introduced plant species *Elodea canadensis*, *Lemna trisulca*, and *Chara rudis*. Rodwell's type A15 *Elodea canadensis community* shows certain affinities with the vegetation found in these waterbodies.

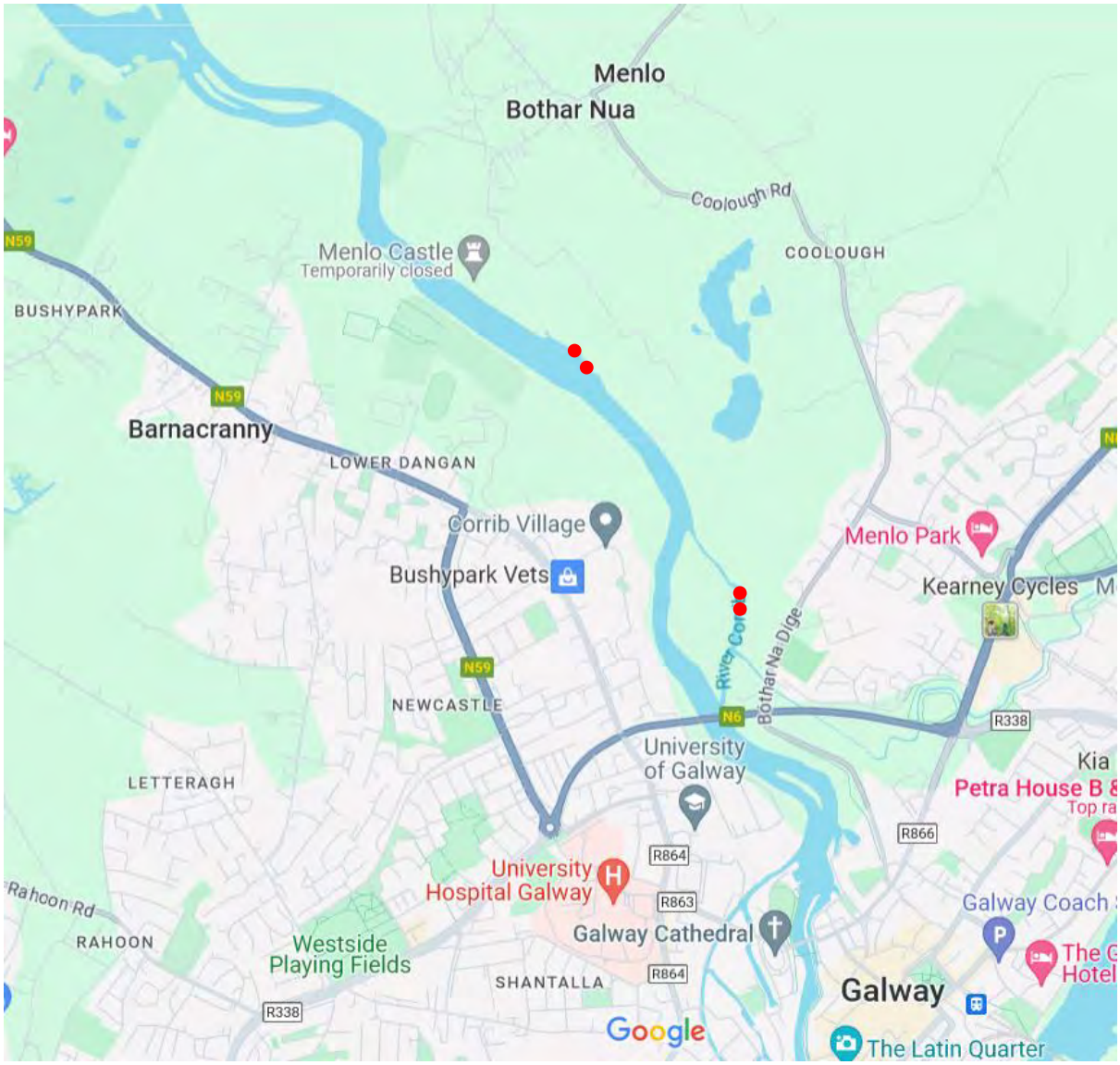

Figure 5 - Distribution of Littorella patches within the survey area in 2023

2.5 Conclusions

The aquatic communities of the river are of significant interest due to the diversity of the aquatic species, including significant stands of pondweeds and charophytes and the presence of the Starry Stonewort *Nitellopsis obtusa.* Aquatic vegetation extends along the margins and around islands and reefs along the full length of the river and also across most of the various side channels fed by the river. Based on the above, and applying the precautionary principle, the full extent of the River Corrib from Lough Corrib to the coast is considered to correspond to the Annex I habitat vegetation of flowing waters 3260, considering the broad interpretation of the habitat currently applied in Ireland.

[6] These codes represent the following vegetation communities from Rodwell (1995): A22 *Littorella uniflora – Lobelia dortmanna* community, A23 *Isoetes lacustris/setacea* community, and A24 *Juncus bulbosus* community.

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