

Moneygall Village Biodiversity Management Plan 2020



Prepared by Triturus Environmental Ltd. for
Moneygall Development Association
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1. Introduction

1.1 Background

Triturus Environmental Ltd. were contracted by Moneygall Development Association to conduct a biodiversity audit of the Moneygall Stream and surrounding environs in July-September 2020 (refer to Figure 1.1 below). The primary aims of the study, as agreed with the Moneygall Development Association, were to undertake the biodiversity management initiatives outlined below.

- Record the wildlife in and surrounding the Moneygall Stream (Ballyfinboy tributary) and make recommendations on how to regenerate the stream as well as manage and enhance general biodiversity in the wider Moneygall area.
- The habitat management would be focused on the Moneygall Stream in the non-culverted area near Moneygall FC grounds but also include open areas of channel downstream.
- The study would collate both baseline physiochemical water quality data (analysed by a laboratory) and biological water quality data (i.e. Q samples which determine water quality from riverine invertebrates).
- The study would also help generate an understanding and identification of the sources of pollution within the Moneygall Stream and make recommendations to buffer nutrient input.

Data collated on local species and habitats would facilitate better understanding, appreciation and, ultimately, management of biodiversity in the Moneygall area. It will also facilitate more effective engagement with local the community and groups alike, such as the Moneygall Development Association and local schools who can partake in the biodiversity initiatives.

1.2 Selected biodiversity policies in the Offaly County Development Plan 2021-2027

Following a review of the targets of the Offaly County Development Plan 2021-2027, ten targets were considered of relevance to this plan. These targets were considered with regards the management proposals within this report to help promote biodiversity in the village through habitat creation and enhancement. They would also be achieved through the future preservation of existing features of high biodiversity value in the local context.

- **BLP-01:** It is Council policy to protect, conserve, and seek to enhance the county's biodiversity and ecological connectivity.
- **BLP-02:** It is Council policy to conserve and protect habitats and species listed in the Annexes of the EU Habitats Directive (92/43/EEC) (as amended) and the Birds Directive (2009/147/EC), the Wildlife Acts 1976 (as amended) and the Flora Protection Orders.
- **BLP-07:** It is Council policy to support the implementation of the National Biodiversity Action Plan 2017- 2021 and the Offaly Heritage Plan Key Actions 2017-2021 and future editions in partnership with relevant stakeholders subject to available resources.

- **BLO-10:** It is an objective of the Council to maintain a riparian zone for larger and smaller river channels based on the Shannon Regional Fisheries Board Guidance Document, *'Planning for Watercourses in the Urban Environment, a Guide to the Protection of Watercourses through the use of Buffer Zones, Sustainable Drainage Systems, Instream Rehabilitation and Recreational Planning'*.
- **BLO-13:** It is an objective of the Council to consider the making of Tree Preservation Orders to protect trees and woodlands of high value.
- **BLO-14:** It is an objective of the Council to encourage the preservation and enhancement of native and semi-natural woodlands, groups of trees and individual trees, (a) in particular, on the grounds of Country Houses, Gardens and Demesnes and on approaches to settlements in the county; and (b) as part of the development management process, require the planting of native, deciduous, pollinator friendly trees in all new developments where possible.
- **BLO-15:** It is an objective of the Council to encourage pursuant to Article 10 of the Habitats Directive, the management of features of the landscape, such as traditional field boundaries, important for the ecological coherence of the Natura 2000 network and essential for the migration, dispersal and genetic exchange of wild species.
- **BLO-16:** It is an objective of the Council to encourage the retention, wherever possible, of hedgerows and other distinctive boundary treatment in the county. Where removal of a hedgerow, stone wall or other distinctive boundary treatment is unavoidable, provision of the same type of boundary will be required of similar length and set back within the site in advance of the commencement of construction works on the site (unless otherwise agreed by the Planning Authority).
- **BLO-17:** It is an objective of the Council to require all new developments to identify, protect and enhance ecological features by making provision for local biodiversity (for example, through provision of swift boxes or towers, bat roost sites, green roofs, etc.) and provide links to the wider Green Infrastructure network as an essential part of the design process.
- **BLO-19:** It is an objective of the Council to continue to maintain mapping identifying the location of invasive species in the county in conjunction with the National Biodiversity Data Centre.

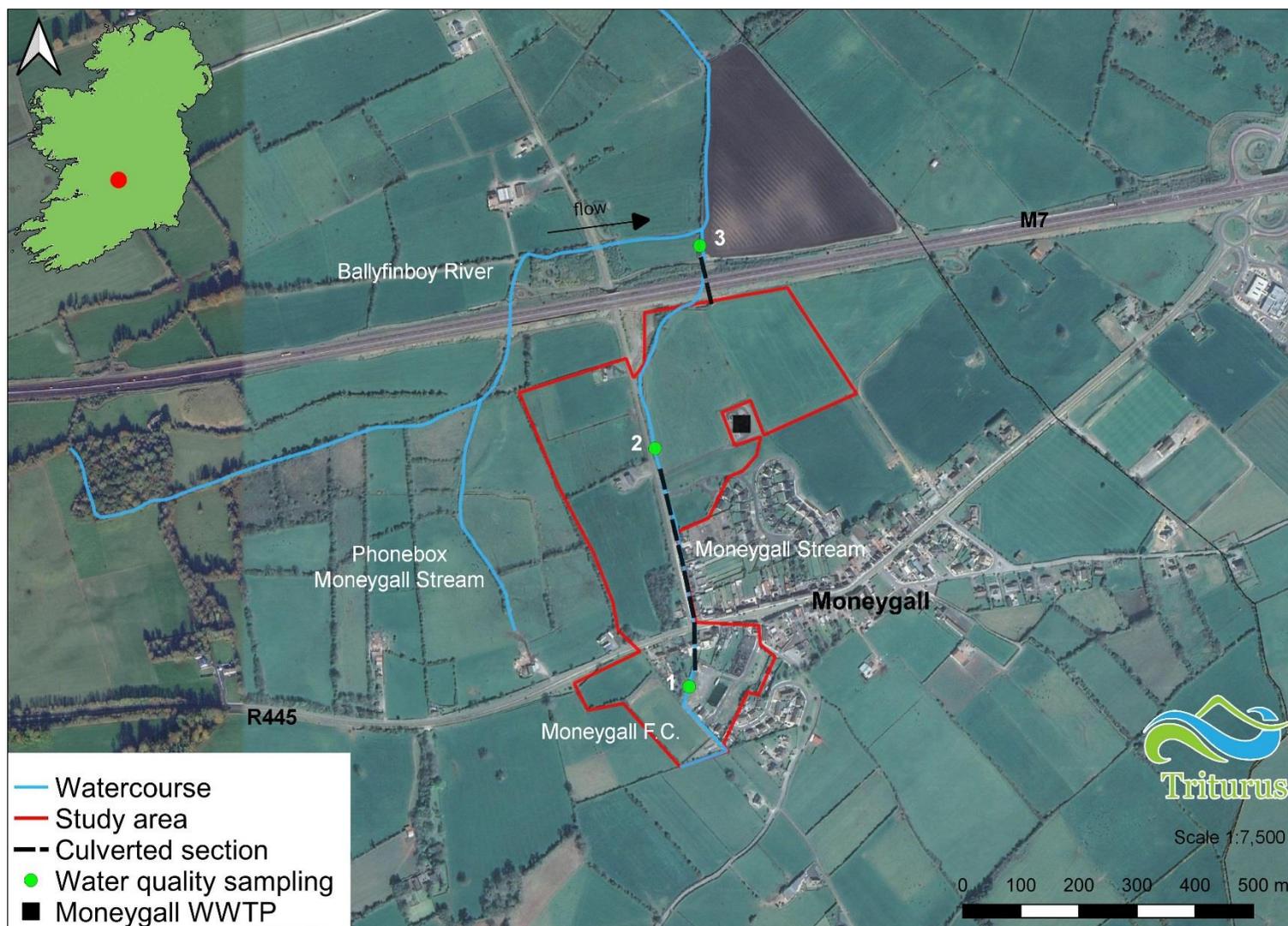


Figure 1.1 An overview map of the biodiversity study area at Moneygall, Co. Offaly.

2. Methodology

2.1 Desktop review – rare and protected flora/fauna

A desktop survey of published and unpublished data for the Moneygall study area was undertaken in respect of rare and or protected flora and fauna. Available information on the status of protected Annex I habitats and Annex II species in the locality was reviewed. This included the site synopsis and Natura 2000 standard data forms for the European sites supporting potential connectivity with the Moneygall study area; i.e. Lough Derg North-east shore SAC (site code: 001181) and Lough Derg (Shannon) SPA (004058). The study area supports remote and tenuous connectivity (located c.32km downstream) to these European sites via the Ballyfinboy River (EPA code: 25B02) and sub-catchment (Ballyfinboy_SC_010).

Specific data sources reviewed included, but were not limited to;

- OSI vector mapping (1:5000, 1:2500 or 1:1000);
- OSI aerial photography (if available);
- NPWS designated area shapefiles, conservation objectives, management plans and other data for designated areas where present;
- Biodiversity Plan for Offaly 2017-2021;
- NPWS data on Annex I habitats (and others, where available) and species of conservation interest, obtained via formal data request;
- Teagasc / EPA National Soils and indicative habitat mapping datasets;
- Geological Survey of Ireland bedrock geology dataset (underlying geology);
- National Biodiversity Data Centre records – rare and protected species records for the general area will be reviewed and lists of any species available for the study area will be compiled;
- WFD fish reporting from Inland Fisheries Ireland and grey literature through our contacts in fisheries for the Ballyfinboy River catchment.

Further data on protected species and habitats, as well as invasive species listed under the Part 1 of the Third Schedule of the European Communities (Birds and Natural Habitats) Regulations 2011-2015, held by the National Parks & Wildlife Service (NPWS), National Biodiversity Data Centre (NBDC) and Botanical Society of Britain & Ireland (BSBI) were reviewed. Water quality data from the Environmental Protection Agency (EPA) was also referred to, as were any previously completed ecological reports available for the survey area.

2.2 Habitat mapping

Walkover surveys of the site were conducted over July and August 2020, with survey effort focused throughout the study site (see Figure 2.1 above). Mapping followed best practice (e.g. Smith et al., 2011). In-stream surveys were facilitated by the use of chest waders and appropriate PPE (i.e. life jacket, wading staff, polarising eyewear). Comprehensive species lists were compiled for each habitat recorded and included vascular plants, invertebrates, amphibians, fish, birds and mammals (see Appendix A for full taxonomic list). Taxonomy and nomenclature followed the

most up-to-date, widely accepted classifications, such as the updated species lists prepared and maintained by the National Botanic Gardens, Glasnevin.

Baseline appraisals of habitat suitability for or used by protected species of conservation interest which are known or suspected to occur within the study area (e.g. Atlantic salmon, lamprey species, otter, kingfisher etc.) were conducted, as well as fisheries potential for other species groups, e.g. Red-listed European eel. The conservation status of recorded species was assessed according to Red Data lists (i.e. Curtis & McGough, 1988; Kingston, 2005; Marnell et al. 2009; King et al. 2011; Lockhart et al., 2012; Wyse-Jackson et al. 2016) and the Flora (Protection) Order, 2015 (S.I. No. 356 of 2015). Species considered by the respective BSBI vice-county recorder to be rare or otherwise notable in the surrounding area were also noted.

Habitats were assessed for field signs and/or usage by mammalian fauna (e.g. otter, fox and badger), such as tracks, scat, spraint, droppings in addition to places of shelter and features or areas likely to be of particular value as foraging resources.

2.3 Invasive species survey

The occurrence, location and density of both aquatic and terrestrial invasive species was noted in respect of the study area, with GPS (ITM) coordinates taken for any records. Primarily the survey focused on common riparian species associated with rivers such as Himalayan balsam (*Impatiens glandulifera*) and Japanese knotweed (*Fallopia japonica*) but other notable invasive plants such as giant rhubarb (*Gunnera tinctoria*) and giant hogweed (*Heracleum mantegazzianum*) were also surveyed for, as were any invasive or potentially invasive aquatic or terrestrial animal species. In particular, those species that were considered of higher risk i.e. listed on Schedule 3 of the Birds and Natural Habitats Regulations 2011 (as amended) were recorded as they are considered to be high threat to local biodiversity.

2.4 Aquatic habitat

Aquatic habitat assessment was conducted according to the methodology given in the Environment Agency's 'River Habitat Survey in Britain and Ireland Field Survey Guidance Manual 2003' (EA, 2003) and the Irish Heritage Council's 'A Guide to Habitats in Ireland' (Fossitt, 2000). The [insert watercourse name] was assessed in terms of:

- Channel width and depth and other physical characteristics;
- Substrate type, listing substrate fractions in order of dominance, i.e. large rocks, cobble, gravel, sand, mud etc.;
- Flow type, listing percentage of riffle, glide and pool in the sampling area;
- Instream vegetation, listing plant species occurring and their percentage coverage of the stream bottom at the sampling site (as applicable) and on the bankside;
- Estimated cover by bankside vegetation, giving percentage shade of the sampling site.

2.5 Fisheries habitat

A baseline fisheries and aquatic habitat survey of the Moneygall Stream (EPA code: 25M51) was completed on the 17th September 2020. An appraisal of fisheries habitat within and adjoining the study area (as far as the Ballyfinboy River confluence, downstream of the M7) was undertaken to establish the importance of different areas as salmonid (Atlantic salmon and brown trout), lamprey, European eel and or general fisheries habitat. The baseline assessment also considered the quality of spawning, habitat and nursery habitat for various fish species within the Moneygall Stream, given the importance to overall biodiversity conservation. This approach facilitated the identification of which areas could/should be prioritised for certain species and the reasoning behind any such management recommendations.

2.6 White-clawed crayfish survey

Suitability for white-clawed crayfish (*Austropotamobius pallipes*) in the Moneygall Stream was assessed during the aquatic survey. The survey was undertaken on 17th September 2020 to establish crayfish presence/absence and population health of this section of the Moneygall Stream.

Survey methodology involved sweep netting of in-channel macrophytes in addition to the checking of typical boulder and cobble refugia (following Reynolds et al., 2010). This process involves the lifting of littoral boulders (single boulder considered a single refuge) while the net is swept underneath to capture any crayfish positioned underneath. As per Inland Fisheries Ireland recommendations (and as with other surveys conducted e.g. fisheries appraisals), crayfish surveys were undertaken in a downstream direction to minimise the risk of upstream mobilisation of crayfish plague or other aquatic invasive species.

Furthermore, riparian walkover surveys examined any spraint from mustelids (i.e. otters & mink) feeding along the riparian corridor to detect crayfish remains. Given that mustelids hunt large areas of river, they can detect cryptic prey, present at low densities, which are not easily attainable via conventional survey methodologies. Whilst not quantitative, riparian walkover/spraint surveys are useful for clarifying the presence of absence of crayfish at a particular site (notably in the wider catchment given the large known territories of male otter, in particular - c.20km).

2.7 Physiochemical water quality

Given an absence of EPA monitoring stations on the Moneygall Stream and upper Ballyfinboy River, physiochemical water quality samples were collected from $n=3$ water quality sampling sites (Figure 1.1) on the 17th September 2020. Samples were cooled and delivered to the laboratory on the same day for analysis. In order to collate a broad water quality baseline for the study area, a range of physio-chemical parameters for each site were laboratory-tested, namely;

- pH
- Alkalinity (mg CaCO₃/l)
- Conductivity @25°C (µS/cm)

- Total Ammonia (mg N/l)
- Total Oxidised Nitrogen (TON) (mg N/l)
- Molybdate Reactive Phosphorus (MRP) (mg P/l)
- Dissolved Organic Carbon (DOC) (mg C/l)
- Biochemical Oxygen Demand (BOD) (mg O₂/l)
- Chemical Oxygen Demand (COD) (mg O₂/l)
- Suspended solids (mg/L)

2.8 Biological water quality (macro-invertebrates)

The aquatic baseline survey included sampling of macro-invertebrate (aquatic insect) species, a standard approach used to calculate water quality (the so-called Q-rating). A combination of field and lab-based methodologies were applied in order to best attain an overview of aquatic invertebrates, with samples typically identified to family level.

Biological water quality was assessed at each aquatic survey site via Q-sampling (Figure 1.1). A total of $n=2$ sites were sampled. Macro-invertebrate samples were converted to Q-ratings as per Toner et al. (2005). All samples were taken with a standard kick sampling hand net (250mm width, 500µm mesh size) from areas of riffle/glide utilising a two-minute sample, as per ISO standards for water quality sampling (ISO 10870:2012). Large cobble was also washed at each site where present and samples were elutriated and fixed in 70% ethanol for subsequent laboratory identification. Any rare invertebrate species were identified from the NPWS Red List publications for beetles (Foster et al., 2009), stoneflies (Feeley et al., 2020), mayflies (Kelly-Quinn & Regan, 2012) and other relevant taxa (i.e. Byrne et al., 2009; Nelson et al., 2011).

Table 2.1 Reference categories for EPA Q-ratings (Q1 to Q5)

Q-Value	WFD Status	Pollution Status	Condition
Q5 or 4-5	High Status	Unpolluted	Satisfactory
Q4	Good Status	Unpolluted	Satisfactory
Q3-4	Moderate Status	Slightly polluted	Unsatisfactory
Q3 or 2-3	Poor	Moderately polluted	Unsatisfactory
Q2, 1-2 or 1	Bad	Seriously polluted	Unsatisfactory

2.9 Macrophyte (aquatic plant) and bryophyte survey

Macrophyte (aquatic plant) and bryophyte (aquatic mosses and liverworts) surveys were conducted alongside macro-invertebrate Q-sampling and included an assessment of floating river vegetation (potential Annex I habitat) and other rare or notable species. The spread and species diversity of floating river vegetation – a legally protected habitat type in Europe - including but

not limited to *Ranunculus* (water crowfoot species), *Callitriche* (water starwort species) and *Potamogeton* (pondweed species) within the Moneygall Stream study area was also evaluated.

2.10 Avifaunal (bird) survey

A bird survey was conducted along the corridor of the Moneygall Stream and within the adjoining terrestrial habitats within the study area boundary on Friday the 31st July 2020. The survey was not quantitative given the constraints of the scope of the study but did provide a good indication of the bird species diversity in Moneygall Village. Birds were identified visually (with binoculars) and audibly within the study area and notes their conservation status were listed according to the Birds of Conservation Concern in Ireland 2014-2019 guidance (BoCCI; Colhoun & Cummins, 2013).

2.11 Biosecurity

In keeping with standard best practice for environmental surveys, a strict biosecurity protocol following the Check-Clean-Dry approach was employed during the survey. Equipment and PPE used was disinfected with Virkon[®] to prevent the transfer of pathogens and/or invasive species between survey areas. Surveys were undertaken at sites in a downstream order (i.e. uppermost site surveyed first etc.) to prevent the upstream mobilisation of invasive propagules and pathogens.

3. Results

3.1 Desktop review

Records of rare, protected and invasive species of flora and fauna from the 2km grid square supporting the Moneygall area (S08F) was obtained from the National Biodiversity Data Centre (NBDC) [online database](#). A number of bird and mammal species of conservation value were available for the surrounding area, including sky lark (*Alauda arvensis*), badger (*Meles meles*) and pine marten (*Martes martes*), in addition to three bats species. Table 3.1 below summarises the protected species and invasive species records held by the National Biodiversity Data Centre for the 2km grid square supporting the Moneygall area (S08F).

No fisheries data was available for the Moneygall Stream (unsurprising given its small, short nature and location in the very upper Ballyfinboy catchment). However, the Ballyfinboy River is recognised as an important salmonid spawning tributary for Lough Derg (McGee et al., 2017). In its lower reaches (at Ballinderry Bridge), the river is known to support brown trout (*Salmon trutta*) and Atlantic salmon (*Salmo salar*) (Kelly et al., 2013). The Ballyfinboy catchment (not including the Moneygall Stream) supports a small run of migratory 'Croneen', a rare and genetically-distinct strain of brown trout endemic to Lough Derg.

White-clawed crayfish (*Austropotamobius pallipes*), an Annex II species, are known from the middle and lower reaches of the Ballyfinboy River (Co. Tipperary, Lucey & MacGarrigle, 1987) but no records were available for the study area or upper catchment. Records were available for adjoining 2km grid square S07E on the unconnected Ollatrim River (NBDC data).

There was no water quality data available for the Moneygall Stream (but see sections 3.5 and 3.6). However, there are a number of EPA monitoring stations on the downstream-connecting Ballyfinboy River. In 2017 the Ballyfinboy achieved Q3-4 moderate status water quality at station RS25B020070, approx. 6km downstream of the Moneygall Stream confluence. The Ballyfinboy's water quality was reduced to Q3 'poor status' upstream of CloghJordan (2017). All other contemporary EPA data available for the river record a Q3-4 moderate water quality and the wider Ballyfinboy catchment is at risk of not achieving target good status ($\geq Q4$) under the Water Framework Directive. The sub-catchment containing the Moneygall Stream (Ballyfinboy_SC_010) is exposed to a number of water quality threats, namely agriculture, hydromorphology (historical drainage), extractive industries (quarries) and urban waste water (EPA [data](#)). Further water quality data has been collated as part of this report by the authors and is presented in section 3.5 below.

Table 3.1 Protected species and invasive species records held by the National Biodiversity Data Centre (NBDC) for 2km grid square (tetrad) S08F.

Species name (common name)	Record count	Date of last record	Title of dataset	Designation
Barn swallow (<i>Hirundo rustica</i>)	1	31/07/1991	The Second Atlas of Breeding Birds in Britain and Ireland: 1988-1991	Protected Species: Wildlife Acts Threatened Species: Birds of Conservation Concern >> Birds of Conservation Concern - Amber List
Common linnet (<i>Carduelis cannabina</i>)	1	31/12/2011	Bird Atlas 2007 - 2011	Protected Species: Wildlife Acts Threatened Species: Birds of Conservation Concern >> Birds of Conservation Concern - Amber List
Common starling (<i>Sturnus vulgaris</i>)	1	31/12/2011	Bird Atlas 2007 - 2011	Protected Species: Wildlife Acts Threatened Species: Birds of Conservation Concern >> Birds of Conservation Concern - Amber List
House sparrow (<i>Passer domesticus</i>)	1	31/12/2011	Bird Atlas 2007 - 2011	Protected Species: Wildlife Acts Threatened Species: Birds of Conservation Concern >> Birds of Conservation Concern - Amber List
Northern lapwing (<i>Vanellus vanellus</i>)	1	31/12/2011	Bird Atlas 2007 - 2011	Protected Species: Wildlife Acts Protected Species: EU Birds Directive >> Annex II, Section II Bird Species Threatened Species: Birds of Conservation Concern >> Birds of Conservation Concern - Red List
Sky lark (<i>Alauda arvensis</i>)	1	31/07/1991	The Second Atlas of Breeding Birds in Britain and Ireland: 1988-1991	Protected Species: Wildlife Acts Threatened Species: Birds of Conservation Concern >> Birds of Conservation Concern - Amber List
Eurasian badger (<i>Meles meles</i>)	3	31/12/2013	Badger Setts of Ireland Database	Wildlife Act (1976) as amended (2000).

Species name (common name)	Record count	Date of last record	Title of dataset	Designation
European rabbit (<i>Oryctolagus cuniculus</i>)	1	14/04/2013	Atlas of Mammals in Ireland 2010-2015	Invasive Species: Invasive Species >> Medium Impact Invasive Species
Pine marten (<i>Martes martes</i>)	1	31/12/2009	Atlas of Mammals in Ireland 2010-2015	Habitats Directive (92/43/EEC), Annex V; Convention on the Conservation of European Wildlife and Natural Habitats (Bern Convention) Appendix III; Wildlife Act (1976) as amended (2000).
Leisler's Bat (<i>Nyctalus leisleri</i>)	1	03/08/2009	National Bat Database of Ireland	Habitats Directive (92/43/EEC), Annex IV; Convention on the Conservation of European Wildlife and Natural Habitats (Bern Convention) Appendix II; Agreement on the Conservation of Populations of European Bats (EUROBATS); Wildlife Act (1976) as amended (2000).
Pipistrelle (<i>Pipistrellus pipistrellus sensu lato</i>)	1	03/08/2009	National Bat Database of Ireland	Habitats Directive (92/43/EEC), Annex IV; Convention on the Conservation of European Wildlife and Natural Habitats (Bern Convention) Appendix II; Agreement on the Conservation of Populations of European Bats (EUROBATS); Wildlife Act (1976) as amended (2000).
Soprano pipistrelle (<i>Pipistrellus pygmaeus</i>)	1	03/08/2009	National Bat Database of Ireland	Habitats Directive (92/43/EEC), Annex IV; Convention on the Conservation of European Wildlife and Natural Habitats (Bern Convention) Appendix II; Agreement on the Conservation of Populations of European Bats (EUROBATS); Wildlife Act (1976) as amended (2000).

3.2 Habitat mapping

A description of the habitats within the proposed study area are presented below. A habitat map (Figure 3.1) has been prepared to illustrate and classify habitats identified within the Moneygall study area. Characteristic and noteworthy species identified during the site walkover survey are listed and summarised below. Scientific names are provided at first mention only. The habitats recorded were typical of urban and peri-urban environments and their rural / pastoral fringing.

The following habitats (according to Fossitt, 2000) were recorded within the study area;

- Improved agricultural grassland (GA1)
- Amenity grassland (GA2)
- Buildings and artificial surfaces (BL3)
- Spoil and bare ground (ED2)
- Recolonising bare ground (ED3)
- Dry meadows & grassy verges (GS2)
- Lowland depositing watercourse (FW2)
- Mixed broadleaved woodland (WD1)
- Hedgerows (WL1)
- Treelines (WL2)

3.2.1 Amenity grassland (GA2)

This habitat is associated with localised lawns, gardens, parks and playing pitches within the Moneygall study area. Amenity grassland is typically a habitat of poor botanical diversity comprising fine leaved grasses such as red fescue (*Festuca rubra*) and opportunistic herbs such as dandelion (*Taraxacum* agg.), white clover (*Trifolium repens*) and creeping buttercup (*Ranunculus repens*) and the springy turf moss (*Rhytidiadelphus squarrosus*), a ubiquitous species of unimproved or semi-improved grassland. Some areas of amenity grassland, such as those located at Elderberry Drive, fringing the R445 west of Moneygall, and the Mountain View housing estate support accompanying tree clusters (including maple (*Acer* sp.), sycamore (*Acer pseudoplatanus*), small leaved lime (*Tilia cordata*) and cherry (*Prunus* sp.)) and areas of ornamental (non-native) shrub planting; i.e. berberis (*Berberis* sp.), rose of Sharon (*Hypericum calycinum*), Japanese rose (*Rosa rugosa*) and butterfly bush (*Buddleja davidii*).

This habitat has poor botanical diversity but does offer the sufficient grounds to implement or adopt biodiversity measures.

3.2.2 Improved agricultural grassland (GA1)

The fringing environs of the Moneygall study areas support this grassland habitat. This habitat is a result of ongoing management practices associated with dairy and beef farming includes ongoing fertilisation and reseeding or grassland swards. As a result, these management practices influence the development of mono-specific grassland swards with occasional occurrences of broadleaved herbs that can thrive in nutrient-rich, continually grazed environments. Improved grassland habitats fringing the Moneygall study areas support dominant perennial rye grass

(*Lolium perenne*) with occasional white clover, mouse-ear chickweed (*Cerastium fontanum*), creeping buttercup, broad-leaved dock (*Rumex obtusifolius*). Localised areas of poor draining ground support soft rush (*Juncus effusus*).

3.2.3 Buildings and artificial surfaces (BL3)

This habitat includes the existing buildings and hard-standing areas within the study area and its surrounding environs to include roads, footpaths, all-weather astro turf pitches etc. These habitats typically support poor botanical diversity. However, buildings with suitable crevices, hollows or apertures may provide suitable nesting and foraging habitats for bats and cavity dwelling birds.

3.2.4 Dry meadows & grassy verges (GS2)

Within the Moneygall study area, this habitat typically occurs where amenity grassland has remained unmanaged over the short-term. Due to ongoing lack of management, the establishment and dominance of stout, tussocky grasses and bramble (*Rubus fruticosus* agg.) has occurred. Some discrete sections of this habitat are located near and adjoining the park area at Elderberry Drive. These areas support common species such as cock's-foot (*Dactylis glomerata*), false oat grass (*Arrhenatherum elatius*), creeping bent (*Agrostis stolonifera*), creeping buttercup, hogweed (*Heracleum sphondylium*), creeping thistle (*Cirsium arvense*), timothy (*Phleum pratense*), cleavers (*Galium aparine*), cow parsley (*Anthriscus sylvestris*), Yorkshire fog (*Holcus lanatus*), hedge woundwort (*Stachys sylvatica*) and hedge bindweed (*Calystegia sepium*).

3.2.5 Lowland depositing watercourse (FW2)

This habitat includes the uppermost reaches of the Moneygall Stream (EPA code: 25M51), a small, historically modified channel flowing from Moneygall village to the confluence with the Ballyfinboy River, downstream of the M7. The stream supported low flows at the time of survey and was heavily vegetated by common aquatic plants such as watercress (*Nasturtium officinale*) and fool's watercress (*Apium nodiflorum*). Levels of siltation were high throughout the study area although decreased significantly downstream of the M7 culvert. Whilst the stream supported species such as common frog (*Rana temporaria*) and the pollution-tolerant three-spined stickleback (*Gasterosteus aculeatus*), fisheries value was low overall. However, some improved suitability for salmonids (brown trout) and brook lamprey (*Lampetra planeri*) was present in the lower survey reaches, near the Ballyfinboy River confluence.

Please refer to section 3.3 for a more detailed description of aquatic habitats.

3.2.6 Spoil and bare ground (ED2) / Recolonising bare ground (ED3)

Both of these habitats are common in urban area, particularly areas that have been unmanaged over the short to medium-term or where they occur on the fringes of recently developed areas. In urban and peri-urban environments, they often support the greatest plant species biodiversity as they comprise a suite of perennial or early pioneer / colonising species establishing on bare ground. The Moneygall area supports small sections of this habitat near the recently constructed

Moneygall Soccer pitch. Species composition of these habitats include rape (*Brassica napus*), silverweed (*Potentilla anserina*), nipplewort (*Lapsana communis*), nettle, hoary willowherb (*Epilobium parviflorum*), redshank (*Persicaria maculosa*), groundsel (*Senecio vulgaris*), greater plantain (*Plantago major*), white clover and creeping bent.

The northern fringes of Moneygall soccer pitch support well-established recolonising bare ground habitat with abundant, tall ruderal species including broad leaved dock, fat hen (*Chenopodium album*), rape, fumitory (*Fumaria officinalis* agg.), spear thistle, cow parsley, American willowherb (*Epilobium ciliatum*), red dead-nettle (*Lamium purpureum*), redshank, knotgrass (*Polygonum aviculare*), nipplewort, couch grass (*Elytrigia repens*), hoary willowherb and common field speedwell (*Veronica persica*). The diversity of ruderal plants in this area, many of which provide foraging material for seed-eating birds, resulting in the presence of small flocks of goldfinch (*Carduelis carduelis*), house sparrow (*Passer domesticus*) and linnet (*Carduelis cannabina*) within this area during the site walkover survey.

3.2.7 Horticultural lands (BC2)

This habitat comprises Moneygall Community Garden; i.e. an organic garden operated by volunteers to promote healthy living and sell local organic produce at the Cottage Markets. It is located on the southern bounds of Moneygall soccer pitch and supports polytunnels, vegetable plots and fruit trees.

3.2.8 Mixed broadleaved woodland (WD1)

This habitat includes a small copse of broadleaved woodland located immediately north of the R445. The woodland is a narrow copse dominated by sycamore with occasional elm (*Ulmus* sp.) and ash (*Fraxinus excelsior*). The woodland shrub and ground layer is heavily shaded and supports occasional holly (*Ilex aquifolium*), hawthorn, elder, lord's and ladies (*Arum maculatum*), hart's tongue (*Asplenium scolopendrium*), broad buckler fern (*Dryopteris dilatata*) and occasional ivy (*Hedera hibernica*). The eastern fringe of this woodland adjoins Moneygall well and is comparably wetter, comprising alder (*Alnus glutinosa*), grey willow (*Salix cinerea*) and ash.

3.2.9 Hedgerows (WL1)

Hedgerows are associated with the fringes of the study area, where developments such as Moneygall soccer pitch, community garden and housing estates adjoin pastoral fields. Hedgerows near and adjoining Moneygall soccer pitch support abundant hawthorn with occasional elder and spreading bramble. A double-sided hedgerow adjoins the western margins of the R490 and supports wych elm (*Ulmus glabra*), maple (*Acer* sp.), ash and willow (*Salix* sp.). A discontinuous hawthorn hedge adjoins the northern boundary of the housing estate located near the northern boundary of the study area.

3.2.10 Treelines (WL2)

Treelines adjoin the north-eastern fringes of the Moneygall study area and are associated with the field boundaries of the large improved grassland fields. These treelines are typically unmanaged and comprise ash and sycamore overtopping hawthorn and willow.



Plate 3.1 Amenity grassland (GA2) at Elderberry Drive



Plate 3.2 Recolonising bare ground (ED3) near Moneygall FC



Plate 3.3 Recolonising bare ground located on the northern boundary of Moneygall FC



Plate 3.4 Moneygall Stream immediately upstream of the R445 in Moneygall village



Plate 3.5 Amenity grassland located on the margins of the R445, west of Moneygall



Plate 3.6 Moneygall community garden



Plate 3.7 Moneygall wishing well located on the western side of the R490



Plate 3.8 Invasive Japanese knotweed located on unmanaged grassland west of the R490



Plate 3.9 Amenity grassland (GA2) associated with the Rathcarn housing estate



Plate 3.10 Amenity grassland (GA2) located on the SE corner of the Mountain View housing estate



Figure 3.1 Habitat map of the study area (habitat codes according to Fossitt, 2000)

3.3 Fisheries and aquatic habitat

The aquatic study area comprised the Moneygall Stream (EPA code: 25M51) as far downstream as the confluence with the upper Ballyfinboy River (25B02), adjacent to the M7 (refer also to Figure 1.1). Observations on fisheries habitat/potential and aquatic habitats are provided below, moving in a downstream direction along the channel.

3.3.1 Moneygall Stream – upper survey reaches

The uppermost reaches of the Moneygall Stream were located to the north of Moneygall FC pitch. Here, the channel supported an imperceptible flow and very shallow water at the time of survey and was heavily encroached with macrophyte vegetation (primarily watercress). The banks were heavily scrubbed over with ruderal and herbaceous species. The stream at this point represented a shallow, drainage channel habitat and offered little fisheries value, apart from perhaps some limited suitability for the ubiquitous three-spined stickleback and common frog were recorded here during the site visit. The upper reaches of the stream had been historically realigned (straightened) and deepened. It flowed along the Community Garden, Moneygall FC and Elderberry Drive boundaries before a more open but heavily vegetated 60m section existed before becoming culverted under residential properties and the R445 road (Main Street).



Plate 3.11 The heavily vegetated upper reaches of the Moneygall Stream near Elderberry Drive, facing downstream (little if any fisheries value present)

3.3.2 Moneygall Stream – middle survey reaches

North of the R445 (Main Street), the Moneygall Stream was extensively culverted for c.250m parallel to the R490, under residential properties and amenity grassland associated with Rathcarn housing estate. The low-flow stream re-emerged from a twin-pipe culvert at the track crossing to Moneygall WWTP (ITM 602678 ,681217; Plate 3.12), approximately 30m north of the Rathcarn estate entrance. It was only once a secondary (pipe) culverted channel adjoined the Moneygall Stream from the west (at ITM 602664,681256) that the stream became a more substantial watercourse as it flowed parallel to the R490. The banks and hawthorn-dominated hedgerow (WL1) along this section of stream had recently been cleared/flailed at the time of survey (Plate 3.13). The channel had also been historically straightened (but not deepened) from this point as far as the M7 culvert approx. 370m downstream.



Plate 3.12 The Moneygall Stream re-emerges from an underground culvert north of Rathcarn

The stream was 1-1.5m wide and averaged 0.2-0.3m deep, flowing in a shallow U-shaped channel in improved agricultural grassland. The substrata were dominated by fractions of sand with frequent boulder and scattered larger cobble. Siltation was high overall, which reduced the fisheries potential considerably. The channel was bound a historical retaining wall underneath the hedgerow on the west bank, with a narrow riparian zone fenced-off on the east bank. Although recently cleared, this evidently supported nutrient-rich species such as nettle, reed canary grass (*Phalaris arundinacea*), hogweed, yarrow (*Achillea millefolium*), meadowsweet and bramble (mostly flailed, however). Instream, macrophytes were very limited, with only occasional fool's watercress (*Apium nodiflorum*) and a single patch of branched bur-reed (*Sparganium erectum*), which had been flailed. Fountain feather moss (*Hygroamblystegium tenax*) was present on some instream boulders. Great scented liverwort (*Conocephalum conicum*) and jagged germanderwort (*Riccardia chamedryfolia*) were present locally along stream banks. The site featured a moderate flow but recent clearance and instream brash significantly slowed the flow

(Plate 3.13). Despite this, the water quality appeared good and the site held some low to moderate fisheries potential for salmonids and brook lamprey (*Lampetra planeri*). Three-spined stickleback, a highly pollution-tolerant fish species, were recorded during sweep netting of macrophytes.

The stream was open for approx. 120m before a more heavily vegetated section was present upstream of the M7 crossing. Here, the channel averaged 2m wide and 0.3m deep but featured a near total cover of watercress (*Nasturtium officinale*) (and some localised fool's watercress) (Plate 3.14). This section of river had not been cleared as per upstream although some localised tree cutting (willow) had recently taken place along both banks. The riparian zone supported great willowherb, nettle, bramble, meadowsweet and reed canary grass with scattered willow, hawthorn and alder. Three-spined stickleback were plentiful within the macrophyte refugia. Although the stream bed supported sand and mixed gravels, these were heavily silted which reduced value for salmonids.

In the vicinity of the M7, the channel flowed through a dense area of willow-dominated scrub (some of which had been flailed recently). Near the M7 culvert, the channel had been historically straightened and over-deepened (>2.5m bankfull height in a V-shaped channel). Here, the channel again featured a very high coverage of watercress and fool's watercress (>90% cover). The riparian zone was dominated by rank grasses (GS2) with scattered grey willow, blackthorn, elder, bramble, creeping thistle, tormentil (*Potentilla erecta*), yarrow, cocks-foot, cleavers, gorse (*Ulex europaeus*), wild angelica (*Angelica sylvestris*) and nettle. Although a moderate flow was present, this area of the Moneygall Stream had poor fisheries value given the very high coverage of macrophytes, siltation of instream gravels and shallow depth (0.1m average).

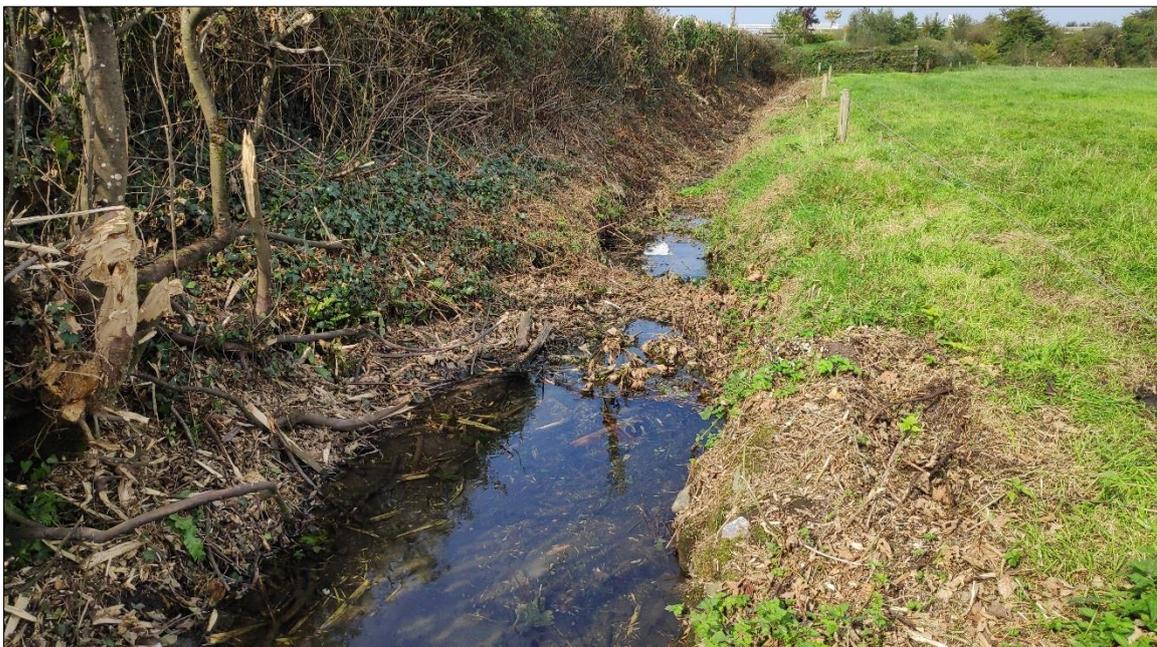


Plate 3.13 The Moneygall Stream downstream of the confluence with an unnamed culverted channel. The stream suffered from heavy siltation at this location and the banks had been recently cleared.



Plate 3.14 The Moneygall Stream supported excessive aquatic plant growth near the M7, indicative of high nutrient enrichment

3.3.3 Moneygall Stream – lower survey reaches

Downstream of the M7 culvert, upstream of the Ballyfinboy confluence, the river was more semi-natural although it had been historically straightened and deepened and was bound by mature boulder revetment (Plate 3.15). The area at the M7 culvert featured stagnant pool habitat with very high cover of fool's watercress and watercress (near 100%) but downstream of the access track crossing the stream's aquatic and fisheries habitat improved substantially with relatively clean fine to medium gravels with scattered cobble and boulder (good spawning habitat if lamprey and salmonids present). Some larval lamprey habitat was present marginally (but silt accumulations were typically shallow, reducing potential). Overall, siltation was moderate downstream of the motorway but the adjoining Ballyfinboy River (60m downstream of the M7 culvert) was heavily silted and appeared to be suffering from other water quality issues.

Instream bryophytes were limited to the submerged form of jagged germanderwort. The channel was lined by watercress with occasional brooklime (*Veronica beccabunga*) with localised common water starwort (*Callitriche stagnalis*). The liverwort species overleaf peltia (*Pellia epiphylla*) was present on muddy damp banks. The stream averaged 1.5m wide and 0.1-0.2m deep. The stream was adjoined by improved agricultural grassland with a hawthorn/elder/bramble hedgerow on the east bank. The sloping stream banks were exposed to regular cattle poaching (no riparian fencing) but supported nettle, dog rose (*Rosa canina*), creeping thistle, spear thistle, ragwort, wavy bittercress (*Cardamine flexuosa*), creeping buttercup, American willowherb, cocksfoot, broad-leaved dock and rank grasses.



Plate 3.15 The fisheries and aquatic habitat of the Moneygall Stream improved substantially downstream of the M7 culvert, with cleaner substrata and a more natural channel form

3.4 White-clawed crayfish survey

Despite some physical habitat and physiochemical suitability, no white-clawed crayfish were recorded from the Moneygall Stream during the site surveys. Whilst historical records exist for the species further down the Ballyfinboy catchment, no records were available for crayfish in the Moneygall Stream. Given the location in the very upper catchment, and in a small stream channel, this is unsurprising.

3.5 Physiochemical water quality

The physiochemical water quality recorded at the three sampling sites is summarised below in **Table 3.2**. The pH levels across the three sites was slightly alkaline, ranging from 7.37-7.47. The Moneygall Stream sites were high alkalinity, with values $\geq 264\text{mg/l CaCO}_3$, and also featured high conductivity $\geq 591\mu\text{S/cm}$, both reflecting the local calcareous geology.

All three sampling sites featured **very high** levels of total oxidised nitrogen (nitrate + nitrite), with all sites exceeding 4.7mg N/l, respectively. In most instances the nitrite fraction comprises <1% of the total, so total oxidised nitrogen is taken to be equivalent to the nitrate concentration in rivers. The European Union Environmental Objectives (Surface Waters) (Amendment) Regulations 2019 (S.I. 77/2019) sets no specific boundary conditions for nitrate. However, EPA assessment of high-quality water sources has set boundary conditions of 0.8 mg/l NO₃-N (nitrate as nitrogen) for high quality waters and 1.8 mg/l NO₃-N for good quality waters. Thus, the Moneygall Stream **failed** to meet good quality standards according to nitrate levels. Such high levels of nitrogen compounds indicate an upstream source(s) of enrichment (eutrophication). Nitrate is the primary form of nitrogen used by plants as a nutrient to stimulate growth. Excessive amounts of nitrogen typically result in aquatic plant proliferations (as was evident in the Moneygall Stream).

The Moneygall Stream sites had low levels of total ammonia (≤ 0.02 mg N/l) and thus met the standards for high-quality water according to the European Union Environmental Objectives (Surface Waters) (Amendment) Regulations 2019 (S.I. 77/2019). The unionised form of ammonia, even in very low concentrations, is toxic to aquatic life, particularly fish.

With regards nutrients, molybdate reactive phosphate (MRP) levels were low across all sites and thus all met high status in this regard as required in the Surface Water Regulations (i.e. levels ≤ 0.025 mg P/l). However, phosphorus is typically bound in sediment (where present) and plant material during the growing season, thus our single-sample results may not accurately reflect true levels of phosphorus within the Moneygall Stream. The high coverage of instream macrophytes near the M7 would suggest high phosphorus levels are, in fact, present.

Biochemical Oxygen Demand (BOD), the amount of oxygen consumed by microorganisms in breaking down the organic matter, for all sites was ≤ 0.5 mg/l O₂ (**Table 3.2**). Therefore, all sampling sites fell within acceptable limits for clean river water (i.e. ≤ 2.6 mg/l O₂ 95th percentile) as set out under the under the European Union Environmental Objectives (Surface Waters) (Amendment) Regulations 2019 (S.I. 77 of 2019).

Levels of DOC, COD and suspended solids all fell within accepted parameters. There were no visible point sources of pollution within the Moneygall Stream but evidently diffuse sources (i.e. derived from agriculture) were impacting the watercourse (i.e. high nitrate levels). It is possible that hidden point sources were present within the culvert network but were not detected during the site survey.

Table 3.2 Summary of physio-chemical water quality results for the Moneygall Stream, September 2020.

Parameter	Site 1	Site 2	Site 3
pH	7.37	7.47	7.46
Conductivity @25°C (µS/cm)	591	591	623
Alkalinity (mg CaCO ₃ /l)	271	264	277
Total Oxidised Nitrogen (mg N/l)	4.985	4.960	4.795
Total Ammonia (mg N/l)	0.008	0.012	0.022
Molybdate Reactive Phosphorus (mg P/l)	0.004	0.013	0.012
DOC (mg C/l)	0.75	0.90	1.17
BOD (mg O ₂ /l)	0.5	0.1	0.3
COD (mg O ₂ /l)	9.5	11.0	12.9
Suspended solids (mg /l)	0.2	0.4	0.8

3.6 Biological water quality (macro-invertebrates)

Q-samples were collected from two sites on the Moneygall Stream (sites 2 and 3). Site 1 was not suitable for Q-sampling given very slight flow of water. A total of $n=14$ species were recorded in the two kick samples collected at sites 2 and 3. A summary of results is presented in **Table 3.3**.

Following the methodology of Toner et al. (2005), the Environmental Protection Agency (EPA) group invertebrates into classes whereby pollution intolerant species are denoted class A, and species with greater pollution tolerance fall into successive classes (B through E, respectively). As such, the presence or absence of these groups and their relative abundance facilitates an assessment of biological river health. Good status (Q4) unpolluted water quality is achieved according to the EPA if at least one Group A taxon is present in, at least, fair numbers (5-10% total sample composition). Group B taxa may be common or absent and *Baetis rhodani* (large dark olive mayfly) is often dominant. Other Group C taxa are never excessive and group D / E taxa are present in small numbers or absent (Toner et. al., 2005). Our results are discussed in this context in order to interpret potential changes in the macroinvertebrate community composition.

The samples were dominated by EPA group C taxa (baetid mayflies, gammarus shrimp & craneflies) with smaller quantities of EPA group B cased caddis. The samples also had small quantities of EPA group D taxa (i.e. wandering snails & freshwater hoglouse). The samples at both sites 2 and site 3 achieved poor status **Q3** water quality based on the absence of EPA group A clean water indicator species and a dominance of EPA group C moderate water quality indicator species. Therefore, neither of the two biological water quality survey sites achieved target good

status **Q4** water quality as required under the Water Framework Directive (2000/60/EC). This is implemented by the recently amended European Union Environmental Objectives (Surface Waters) (Amendment) Regulations 2019 (S.I. No. 77 of 2019) that specify a minimum target EQR of 0.75 or equivalent **Q4** for all rivers.

No rare or protected macro-invertebrate species were recorded in the samples when compared to national red lists for aquatic beetles (Foster et al., 2009), mayflies (Kelly-Quinn & Regan, 2012) and other relevant taxa (e.g. molluscs; Byrne et al., 2009).

The invertebrate community recorded was indicative of a small lowland stream community with reduced water flows and where the effects of organic enrichment and siltation are more often evident (i.e. lower rates of dilution). Such channels typically have a lower invertebrate diversity, particularly in terms of clean water stonefly and mayfly indicator species, as was reflected during the current survey.

The large dark olive mayfly (*Baetis rhodani*) is the most common mayfly in Ireland and one of two mayfly groups (the second being *Caenis*) that are tolerant of eutrophication. The species was common in the Moneygall Stream. Mayflies are readily identifiable because they have three tails as opposed to two in stoneflies as nymphs. As adults they only retain two tails as illustrated in the picture below.

In Britain and Ireland the main hatch usually begins somewhere between mid-May and the first week of June, but there are regional variations. Apart from the obvious differences in their behaviour (males do not lay eggs; females do not swarm) it is relatively easy to differentiate between males and females simply from their appearance. Males are smaller and noticeably darker, especially at the dun stage but also as spinners. The eyes of a male are noticeably larger than those of a female.

Egg-laying spinners are larger and paler than the males, flying a foot or so above the surface touching down periodically to release a batch of eggs. It can be very frustrating for trout as they rush to seize a surface dun or spinner only to see it fly off - something that cannot happen in the final phase of a mayfly's existence once they die following release of eggs. Once all of the mayfly eggs have been deposited, larvae can take two years to develop where they live between the river gravels on the stream bed.



Table 3.3 Summary of the biological water quality (Q-ratings) recorded on the Moneygall Stream, September 2020.

Group	Family	Species	B2	B3	EPA Group
Mayfly	Baetidae	<i>Baetis rhodani</i>	5	16	C
Cased Caddis	Seracostomatidae	<i>Seracostomata personatum</i>		12	B
Cased Caddis	Glossosomatidae	<i>Agapetus fuscipes</i>	8	14	B
Cased Caddis	Limnephilidae	<i>Micropterna sequax</i>	2		B
Caseless Caddis	Polycentropidae	<i>Holocentropus dubius</i>	1		B
Beetle	Elmidae	<i>Limnius volckmari</i>		39	C
Cranefly larvae	Tipulidae	<i>Tiplua sp.</i>		1	C
Hairy eyed crane-fly larvae	Limoniidae	<i>Dicranota sp.</i>		5	C
Freshwater Shrimp	Gammaridae	<i>Gammarus duebenii</i>	36	203	C
Flatworm	Planariidae	<i>Polycleis nigra</i>	12		C
Freshwater hoglouse	Asellidae	<i>Asellus aquaticus</i>		3	D
Wandering snail	Lymnaeidae	<i>Radix balthica</i>	5	2	D
Freshwater worm	Lumbriculidae	<i>Lumbriculus variegatus</i>		1	N/A
Taxon Richness n			7	10	
Q Rating			Q3	Q3	
WFD Status			Poor	Poor	

3.7 Macrophyte (aquatic plant) and bryophyte survey

Aquatic plant diversity in the Moneygall Stream was low. More pen areas of channel featured very high coverage of common species such as watercress and fool's watercress (locally abundant). Branched bur-reed was occasional, as was water mint (*Mentha aquatica*) and brooklime. Common water starwort was present locally downstream of the M7 culvert. Reed canary grass, a species typically found along and often within the margins of watercourses, was present locally in the middle survey reaches.

Aquatic bryophyte diversity was also low, with only occasional fountain feather moss (*Amblestegium tenax*) and jagged germanderwort (*Riccardia chamedryfolia*) present.

No rare or protected aquatic plants, liverworts or mosses were recorded within the study area.

Watercress (*Nasturtium officinale*) is a widespread semi-aquatic member of the cabbage family which favours slow-flowing rivers and streams with a gravel bed. Watercress is most abundant in summer and autumn and hollow stems support small cross-shaped white flowers between March and October. The plant provides valuable refugia for a range of aquatic life, including young fish and white-clawed crayfish (*Austropotamobius pallipes*) especially when present in large mats. As a protection measure, the plant produces compounds that deter invertebrates such as snails from eating it. The plant has also numerous medical properties. In Irish folklore, the plant was deemed a cure for lunacy. In the 16th century, watercress was used as a cure for scurvy, helping sailors' diets when away for long voyages.

While watercress offers a valuable habitat for a range of aquatic species excessive growth, such as that recorded on the Moneygall Stream, is an indication of enriched water (e.g. high nitrate levels).



3.8 Avifaunal (bird) survey

During the site walkover surveys undertaken in August-September 2020, the occurrence and activity of avifauna using the habitats and hinterland of the Moneygall study areas were identified and noted. A list of avifaunal species identified during the site walkover survey and their behaviour and interaction with the study area are presented in **Table 3.4** below. Avifaunal diversity and activity reflect the habitats within the study areas; i.e. peri-urban habitats and their associated built structures, pastoral fields, hedgerows, treelines and areas of ruderal / recolonising bare ground.

Table 3.4 Avifaunal species identified during the site walkover survey

Common name (species name)	Conservation status ¹	Activity and occurrence within the study area
Blackbird (<i>Turdus merula</i>)	Green	Foraging within hedgerows and treelines adjoining the Moneygall study area.
Blue tit (<i>Cyanistes caeruleus</i>)	Green	Foraging within hedgerows and treelines adjoining the Moneygall study area.
Chaffinch (<i>Fringilla coelebs</i>)	Green	Foraging within hedgerows and treelines adjoining the Moneygall study area.
Collared dove (<i>Streptopelia decaocto</i>)	Green	Flushed from hedgerows and treelines adjoining the Moneygall study area.
Goldfinch (<i>Carduelis carduelis</i>)	Green	Foraging within recolonising bare ground adjoining Moneygall football pitch.
Jackdaw (<i>Corvus monedula</i>)	Green	Associated with built up areas within the Moneygall study area.
Pied wagtail (<i>Motacilla alba</i>)	Green	Foraging within the built-up areas and recolonising bare ground within the study area.
Rook (<i>Corvus frugilegus</i>)	Green	Located throughout the study area.
Song thrush (<i>Turdus philomelos</i>)	Green	Foraging within hedgerows and treelines adjoining the Moneygall study area.
Wren (<i>Troglodytes troglodytes</i>)	Green	Foraging within hedgerows and treelines adjoining the Moneygall study area.
House martin (<i>Delichon urbicum</i>)	Amber	Overflying the study area.
House sparrow (<i>Passer domesticus</i>)	Amber	Foraging within the built-up areas and recolonising bare ground within the study area.

¹ Conservation status assigned in accordance with the Birds of Conservation Concern in Ireland (Colhoun & Cummins, 2013)

Common name (species name)	Conservation status ¹	Activity and occurrence within the study area
Linnet (<i>Carduelis cannabina</i>)	Amber	Foraging within recolonising bare ground adjoining Moneygall football pitch.
Robin (<i>Erithacus rubecula</i>)	Amber	Foraging within hedgerows and treelines adjoining the Moneygall study area.
Starling (<i>Sturnus vulgaris</i>)	Amber	Located throughout the study area.
Swallow (<i>Hirundo rustica</i>)	Amber	Overflying the study area.

3.9 Invasive species

Japanese knotweed (*Fallopia japonica*), a plant species listed on the Third Schedule of the Birds and Natural Habitats Regulations 2011-2015 was identified within a private garden on the western verge of the R490 regional road (grid reference ITM 602711 681025; Plate 3.8). There were two stands of Japanese knotweed at this location comprising a main stand to 1.5m height. The stands were located within an unmanaged garden associated with a private residence (Figure 3.1), that has developed into dry meadows and grassy verge habitat (GS2).

The non-native, medium-risk impact (Kelly et al., 2013) Himalayan honeysuckle (*Leycesteria formosa*) was present locally in the roadside hedgerow along the R490 opposite Rathcarn housing estate.

Localised non-native butterfly bush (*Buddleja davidii*), another medium-risk non-native species in Ireland (Kelly et al., 2013), was present adjoining amenity grassland areas at Elderberry Drive and the Mountain View housing estate.

No aquatic invasive species floral or faunal were recorded along the Moneygall Stream.

3.10 Other species of interest

Two common butterfly species, the small tortoiseshell (*Aglais urticae*) (Plate 3.17) and small white (*Pieris rapae*) were frequent along the Moneygall Stream corridor. Common frog (*Rana temporaria*), a species protected under the Irish Wildlife Act (1976, amended 2000), were also recorded occasionally in areas of the stream supporting dense instream vegetation.

Small tortoiseshell (*Aglais urticae*) is perhaps our most common butterfly species, the small tortoiseshell regularly frequents gardens and a wide variety of habitats such as woodlands and river corridors. It is mainly reddish-orange with black markings and blue spots around the border. In contrast, the underside is quite dull. Adults feed on nectar and may hibernate over winter, often in houses. The caterpillars of the species feed almost exclusively on nettle. It is one of the first butterflies to be seen in spring. The image below shows small tortoiseshell butterflies (*Aglais urticae*) feeding on creeping thistle along the riparian zone of the Moneygall Stream.



4. Management for biodiversity

4.1 Short-term management options (2021-2022)

A number of short and medium-term biodiversity management goals have been proposed for Moneygall Village. These include pollinator-friendly initiatives as detailed in the All Ireland Pollinator Plan 2015-2020 (NBDC, 2016), water quality monitoring (invertebrate Q-sampling), wetland/pond creation and the management of amenity grassland areas for biodiversity gain. The locations of proposed management measures are presented in Figure 4.1 below.

4.1.1 Wildflower Meadow Planting (Amenity grassland management)

In essence, the key management measure is the cutting / mowing regime and the restriction of cutting the grassland area until grasses and herbs have been able to set and disperse seed material. Where it is not possible or suitable to leave entire large areas of amenity unmown for large periods of the growing season, it should be possible to retain key areas of strips of amenity grassland vegetation for management as wildflower meadows. Further guidance of grassland management is available from the National Biodiversity Centre webpage; http://www.biodiversityireland.ie/wordpress/wpcontent/uploads/Local%20communities_actions%20to%20help%20pollinators_April%202016.pdf.

Advice on collecting and using wildflower seed is also available from the National Biodiversity Centre webpage; www.biodiversityireland.ie/wordpress/wp-content/uploads/Pollinator-How-to-Guide2_ALT_FINAL.pdf.

Additional guidance on using green hay is available in Natural England's [Technical Information Note TIN063](http://publications.naturalengland.org.uk/file/93010); <http://publications.naturalengland.org.uk/file/93010>.

Information on butterfly and bumblebee identification can be found on the [NBDC website](http://www.biodiversityireland.ie/record-biodiversity/); <http://www.biodiversityireland.ie/record-biodiversity/>.

There are areas of amenity grassland at the Mountain View housing estate, the Rathcarn housing estate and fringing the R445 that can be managed to increase the diversity within the grassland, to promote the establishment of native grasses and broadleaved herbs. A sequence of events to establish semi-natural grassland upon amenity grassland areas are provided below:

- Cut the selected grassland areas once a year in August or September. Harvest (as hay or silage) the cut material and remove from the enhancement area.
- Consider running a wildflower, bee and butterfly recording project in the meadow grassland in conjunction with local schools (e.g. Moneygall National School).
- Register your action for pollinators on the [NBDC website](http://www.biodiversityireland.ie/record-biodiversity/).

Seed or green hay for wildflower meadow creation should be collected from local sources. Diverse wildflower grasslands can also develop through natural recolonisation of disturbed ground, particularly on soils of low fertility (e.g. exposed subsoils, construction waste, etc.). These grasslands may be particularly valuable for invertebrates, as they tend to have more diverse

vegetation structure (including areas of low vegetation and bare ground) compared to planted grasslands.

If some cutting regime is required during the growing season (due to health and safety or other potential hazards / risks), the below sequencing can be applied².

TIPS TO CREATE POLLINATOR-FRIENDLY 6-WEEK MEADOWS

- **First cut after 15th April.** (this will allow Dandelions to flower. Dandelions are a vital food source for pollinators in spring)
- **Second cut at end of May.** (Cutting at the end of May and not again until mid-late July will increase the growth of important plants like Clover, Selfheal, Cuckooflower and Bird's-foot-trefoil).
- **Third cut in mid-late July.** (maximises growth of Clovers and other wildflowers)
- **Fourth cut end August.**
- **Fifth cut after mid-October.**



Natural regeneration from the native seed bank is often pollen-rich and offers food to which our native bees have adapted.

4.1.2 Riparian Management (Moneygall Stream)

The re-naturalisation of the riparian zone of the Moneygall Stream downstream of the WWTP in a heavily improved agricultural field would help buffer the stream from overland nutrient inputs while improving the area for pollinators.

A general rule of thumb when deciding on the size of wildflower habitat is to create patches of wildflowers between 0.25ha-0.5ha per 100ha (Nowakowski, & Pywell, 2016). Therefore, the wildflower meadow should extend for 2m from the banktop zone into the historical floodplain covering a tract of circa. 100m to ensure good area of coverage. The target area is situated in an area of high agricultural intensity; the soil was heavily compacted, poorly drained and likely overly enriched with nitrates due to farming practices. A wildflower meadow mix suitable for calcareous soils should be planted. High soil fertility may represent a challenge for establishing wildflower seed mixes as it encourages rapid and excessive growth of weedy species (Nowakowski, & Pywell, 2016). Therefore, more competitive seed mixes should be chosen coupled with more frequent cutting within the first year, including removal of cuttings, which will reduce the soil fertility and encourage wildflower establishment. The planting of earthen plugs of yellow rattle (*Rhinanthus minor*) will also help reduce grass competition and improve wildflower establishment. Members of the local community including children could grow yellow rattle seeds and plant in the dedicated meadow areas.

² Source: <https://pollinators.ie/practical-advice-on-managing-wildflower-meadows/>

The banktop area extending landward from the stream edge would be planted with a wildflower meadow extending 2m to the existing fenceline and also scattered native trees (e.g. alder, willow and ash). The local landowner should be engaged with to ensure no slurry applications within 15m of the Moneygall Stream to help reduce nutrient inputs and encourage the development of a more diverse and natural plant community.

4.1.3 Wildflower meadow signage

When establishing and managing wildflower meadows, it is important to indicate the purpose of the ongoing management regimes and the associated goals. Simple signs such as the All-Ireland Pollinator Plan's signage (<https://pollinators.ie/resources/signage-templates/>) can be used.

Securing 6" square posts with signage secured to the post face / sides may also be used.

4.1.4 Community garden biodiversity management actions

The below sequence of events are provided to further enhance the Community Garden for pollinators and other wildlife:

- Establish pollinator-friendly perennial plants into the beds and borders.
- Erect bird nest boxes and bird feeders.
- Create a wildlife area leaving an area of grass unmown, creating a log pile and piles of leaves.
- Erect some simple signage highlighting your actions for pollinators. Signage templates are available from the National Biodiversity Data Centre.
- Register your action for pollinators on the [NBDC website](https://pollinators.biodiversityireland.ie/) (<https://pollinators.biodiversityireland.ie/>).
- Moneygall Development Association could find a plot of land within or adjacent to the Moneygall Community Garden to establish and develop a Community Orchard, supporting fruit trees of native, local provenance. The fruit trees could be planted by local families and or by local schools.

4.1.5 Woodland and hedgerow planting

The Rathcarn housing estate supports a large area of amenity grassland. Select areas could be used to establish woodland copses comprising species of native local provenance. Suitable species include pubescent birch (*Betula pubescens*), pedunculate oak (*Quercus robur*), hawthorn (*Crataegus monogyna*) and hazel (*Corylus avellana*).

The Rathcarn housing estate also supports a discontinuous hedgerow near its northern boundary. Efforts could be made to extend this hedgerow structure around the perimeter of the housing estate by 50m-100m, particularly along the perimeter of the amenity grassland areas near the western and northern boundaries.

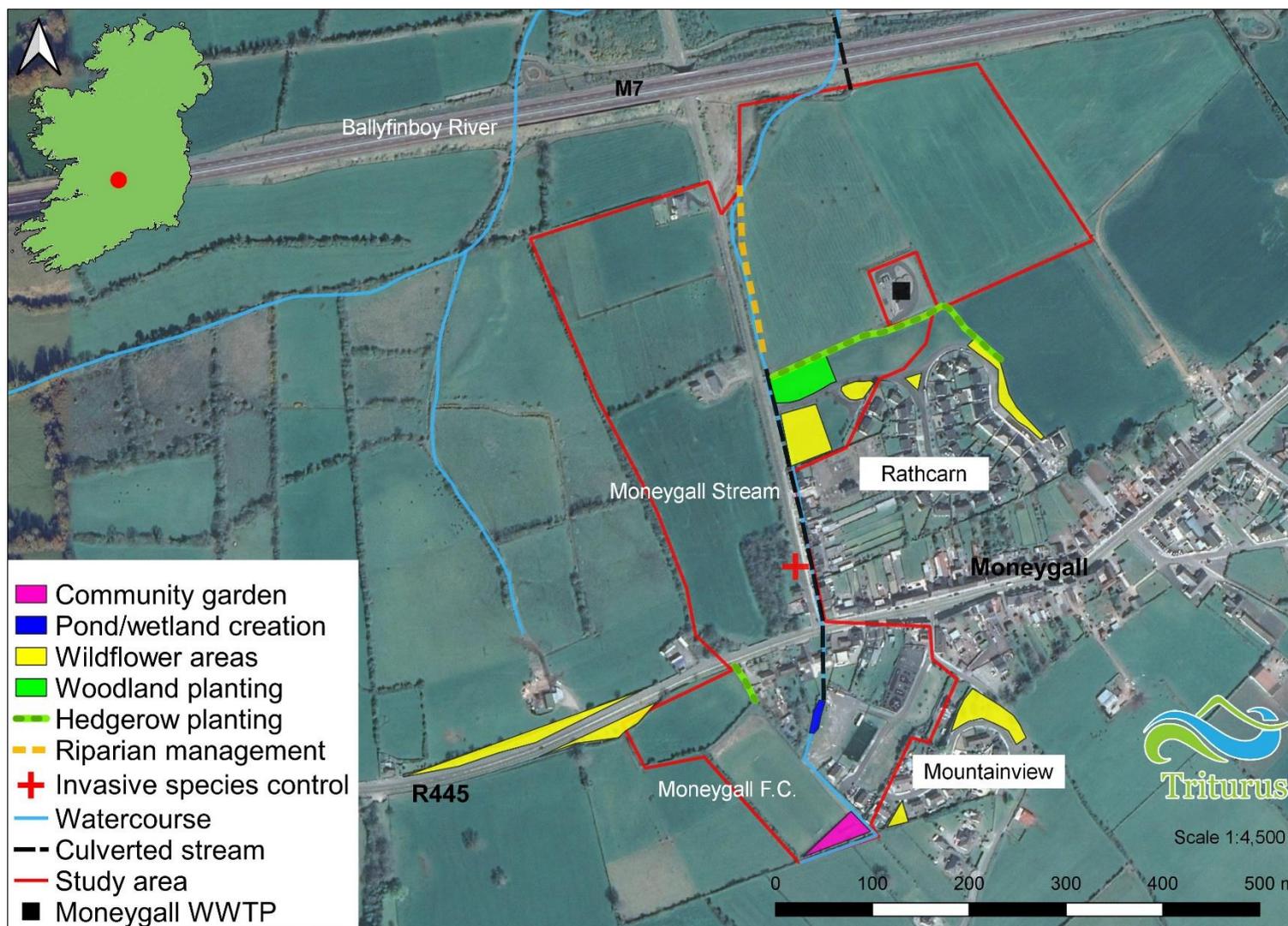


Figure 4.1 Locations of proposed biodiversity management areas within the Moneygall study area

4.1.6 Hedgerow and treelines project

Consider expanding or reconnecting linear woodland habitats between Moneygall village and its surrounding hinterland. This could be a project to be run in tandem with, or with input from, other groups or individuals such as Men's Shed, Transition Year students etc. Trees and shrubs to be used should be native and sourced from local seed sources. Bare-root trees can be planted from November to March inclusive.

A sequence of potential action projects are provided below:

- Review hedgerow condition and management around the village and within areas available to Moneygall Development Association and apply best practice management regime. Cut the hedgerows on rotation so that not all the hedgerows are cut in one year. This will ensure a supply of food for insects and birds through the autumn and winter months.
- Review the potential for hedgerow planting around public spaces, along roadsides and in green areas or boundaries of residential estates in particular to increase connectivity with existing hedgerows, woodland and/or watercourses.
- Review condition and flowering of hedgerows annually. Hedge management techniques such as traditional laying, conservation hedging and wildlife hedging should be considered over coppicing and circular saw cutting; [https://hedgelaying.ie/wp-content/uploads/2019/11/Restructuring-hedges Rejuvenation-management-can-improve-the-long-term-quality-of-hedgerow-habitats-for-wildlife-in-the-UK.pdf](https://hedgelaying.ie/wp-content/uploads/2019/11/Restructuring-hedges_Rejuvenation-management-can-improve-the-long-term-quality-of-hedgerow-habitats-for-wildlife-in-the-UK.pdf).
- Hedgerows should not be cut between 1st March and the 31st August to avoid the bird nesting season. Cutting hedgerows between November and January is less likely to be disruptive to pollinating insects.

Guidance on hedgerow planting and management and is provided below:

- https://www.teagasc.ie/media/website/crops/forestry/advice/stockproofhedge.establishment.factsheet_2.pdf
- <https://www.biodiversityireland.ie/wordpress/wp-content/uploads/Pollinator-How-to-Guide-3-FINAL-1.pdf>

4.1.7 Green infrastructure

Green Infrastructure is the network of habitats where important ecosystem services are provided and in the case of the Moneygall study area are restricted to areas of recolonising bare ground, linear woodland habitats and sections of the Moneygall Stream not culverted under local and regional roads.

Ecological corridors and stepping stones facilitate the movement of plants and animals between Local Biodiversity Areas and between habitats present within Moneygall and throughout its wider hinterland. For Moneygall, the greatest source of ecological connectivity is achieved through the

treelines and hedgerows along the village's periphery. These features should be enhanced and wherever possible, connections should be made between the village and these key features of ecological connectivity. Where existing corridors are limited to narrow watercourses, such as the Moneygall Stream, additional habitat creation or enhancement, such as planting adjoining hedgerows or treelines or even creating additional habitats, would increase this feature's corridor functionality. In addition, the creation of additional habitats will provide buffering for the key corridor feature. We have proposed under medium term measures below means of enhancing the ecological corridor of the Moneygall Stream below.

4.1.8 Raising awareness of biodiversity in Moneygall

A series of ongoing actions to raise awareness of Moneygall's biodiversity is provided in Table 4.1 below.

Table 4.1 Recommended actions to help raise awareness of biodiversity within the Moneygall community

Action	Timeframe	Lead	Support
Dawn chorus community gathering	Annually (May)	Moneygall Development Association	BirdWatch Ireland Local Branch
Retrofitting of buildings within Moneygall village to support key nesting bird species (e.g. swift, house martin) and bats	Ongoing	Moneygall Development Association	BirdWatch Ireland Local Branch / Bat Conservation Ireland
Wildflower walk & talk	Annually (May to September)	Moneygall Development Association	Botanical Society of Britain and Ireland
Invasive/non-native species walk & talk	Within the 5-year plan subject to funding etc.	Moneygall Development Association	Botanical Society of Britain and Ireland
Bat walk	Annually (May to September)	Moneygall Development Association	Bat Conservation Ireland / National Park and Wildlife Service
Bees and butterflies walk & talk	Annually (May to September)	Moneygall Development Association	National Park and Wildlife Service
Biodiversity/pollinator information signs at Moneygall Community Garden	Within the 5-year plan subject to funding etc.	Moneygall Development Association	Offaly County Council
Biodiversity signs within/near village centre	Within the 5-year plan subject to funding etc.	Moneygall Development Association	Offaly County Council
Bioblitz	Annually (summer)	Moneygall Development Association	National Biodiversity Data Centre & local wildlife experts

4.2 Medium-term management (2021-2024)

4.2.1 Pond/ Wetland Habitat Creation

Ponds are an important biodiversity resource in the Irish landscape, supporting a wide variety of plants and animals that live in or near freshwater habitats. They provide connectivity, acting as important stepping stones and refugia for native species (Gioria, 2011).

The creation of an open water pond basin with wetland fringe would greatly improve the biodiversity gains in Moneygall Village given the absence of large surface water features in the village with the exception of the Moneygall Stream. The pond and wetland habitat could be constructed adjacent to the Moneygall FC playing fields adjoining the Moneygall Stream (see Figure 4.1 for suggested location). The pond would not be connected directly to the Moneygall Stream to reduce the potential for infilling by silt. The bank between the pond and the Moneygall Stream could be lowered to encourage the development of a wet grassland and or marsh community adjoining the pond to further increase biodiversity.

The creation of a biodiversity pond between 25m and 50m long and 10m to 20m wide would provide a small pond basin that would attract aquatic invertebrates, water plants, amphibians and water birds (see Figure 4.2 below for schematic of pond design). During pond excavation, it would be important to ensure that the centre of the pond/wetland had a minimum depth of 1.0m to ensure sufficient water depth during dry summers. Please note that the depth of the pond should be maximised to minimise noxious weed growth but space constraints may reduce the feasibility of creating a deeper pond. One to two central islands would also offer opportunities for nesting birds such as moorhen and mute swan.

The sides of the pond should be gently sloping or stepped to allow plants to colonise the edges and allow access to the water for wildlife. Steps provide differing water depths suitable for different aquatic macrophyte plant species. The base of each pond should be lined with a Geotextile Clay Liner (GCL). Commonly used butyl pond liners are not recommended given their propensity to leakages and slowed rate of biodiversity establishment. Native aquatic vegetation could be introduced from a donor site nearby (being free of invasive species/pathogens). This should be undertaken by a suitably qualified ecologist in consultation with the National Parks and Wildlife Service (NPWS) local ranger.

The pond margins could have amphibian hibernacula installed that are piles of rock and log, capped with grass sods to offer winter refugia for common frog and or newt. Furthermore, the option of planting a small stand of alder and ash on one margin of the pond would be beneficial for wildlife including amphibians (see Figure 4.2 below).

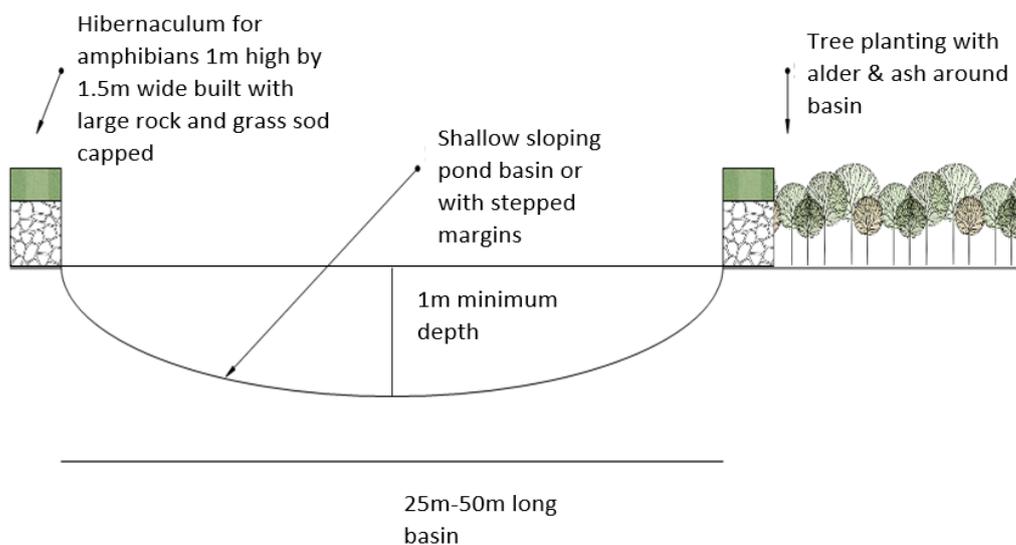


Figure 4.2 Schematic of biodiversity pond design

4.2.2 Invasive Species Management (Japanese Knotweed)

Two small stands of Japanese Knotweed were identified (ITM 602711, 681025) adjoining a block of mixed broadleaved woodland within a private unmanaged garden near the R490 road (Figure 3.1 & Plate 3.8). The spread of this species would be considered a threat to local biodiversity including the adjoining woodland. This small stand of knotweed should be marked by signage and treated by a registered professional. The stand of knotweed should also be treated by a DAFM approved herbicide in accordance with S.I. No. 438/2019 - European Communities (Sustainable Use of Pesticides) (Amendment) Regulations 2019. Normally it would take 3 to 4 years of treatment to improve the chances of eradication. The size of the stand could be measured annually to ensure the efficacy of treatment. No invasive plant material should be removed offsite unless conducted by a licensed invasive plant specialist. Therefore, in-situ treatment would prove the most viable for the Moneygall Development Group.

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6. References

- Byrne, A. W., Moorkens, E. A., Anderson, R., Killeen, I. J., & Regan, E. (2009). Ireland Red List no. 2: Non-marine molluscs. National Parks and Wildlife Service, Department of the Environment, Heritage and Local Government.
- Colhoun, K. & Cummins, S. (2013). Birds of Conservation Concern in Ireland 2014-2019. Irish Birds 9, 523-544.
- Curtis, T.G.F. & McGough, H.N. (1988) The Irish Red Data Book, Vascular Plants Wildlife Service Ireland, Dublin. Published by the Stationary office.
- DEFRA (2007) Hedgerow Survey Handbook. A standard procedure for local surveys in the UK. Defra, London.
- Environment Agency (2003). River Habitat Survey in Britain and Ireland Field Survey Guidance Manual 2003.
- Fitzpatrick, U., Murray, T.E., Byrne, A., Paxton R.J. & Brown, M.J.F. (2006). Regional Red List of Irish Bees. Produced by Queens University Belfast for the Higher Education Authority.
- Fossitt, J. (2000). A Guide to Habitats in Ireland. The Heritage Council, Ireland.
- Gioria, M. (2011). Freshwater Biodiversity in the Irish Agricultural Landscape: The Significance of Ponds. Environmental Protection Agency Ireland. <http://erc.epa.ie/safer/resource?id=f772e614-46de-102f-8c70-b53a025bc1b8>
- Kelly, F.L., Matson, R., Connor, L., Feeney, R., Morrissey, E., Wogerbauer, C. and Rocks, K. (2013) Water Framework Directive Fish Stock Survey of Rivers in the Shannon International River Basin District. Inland Fisheries Ireland, Swords Business Campus, Swords, Co. Dublin, Ireland.
- Kelly-Quinn, M. & Regan, E.C. (2012). Ireland Red List No. 7: Mayflies (Ephemeroptera). National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht, Dublin, Ireland.
- King, J.L., Marnell, F., Kingston, N., Rosell, R., Boylan, P., Caffrey, J.M., FitzPatrick, Ú., Gargan, P.G., Kelly, F.L., O'Grady, M.F., Poole, R., Roche, W.K. & Cassidy, D. (2011). Ireland Red List No. 5: Amphibians, Reptiles & Freshwater Fish. National Parks and Wildlife Service, 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.
- Magee, J., Bradley, C., Hynes, R., Prodöhl, P., Delanty, K., Kelly, F. & O'Grady, M. (2017). Population structure and genetic stock identification of brown trout (*Salmo trutta*) from Lough Derg (Shannon system). Presentation given at Understanding Brown Trout – Genes, Ecology and Citizen Science conference, held on 17th October 2017 at Hodson Bay Hotel, Athlone.
- Marnell, F., Kingston, N. & Looney, D. (2009). Ireland Red List No. 3: Terrestrial Mammals, National Parks and Wildlife Service, Department of the Environment, Heritage and Local Government, Dublin, Ireland

NBDC (2016). Local Communities: actions to help pollinators. All-Ireland Pollinator Plan 2015-2020, Guidelines 1. National Biodiversity Data Centre Series No.4, Waterford. ISSN 2009-6844.

Reynolds, J., Lynn, D., & O'Keefe, C. (2010). Methodology for monitoring Irish lake populations of white-clawed crayfish *Austropotamobius pallipes* (Lereboullet). *Freshwater Crayfish*, 17, 195-200.

Smith, G.F., O Donoghue, P., O Hora, K. & Delaney, E. (2011). Best Practice Guidelines for Habitat Mapping. The Heritage Council.

Toner, P., Bowman, J., Clabby, K., Lucey, J., McGarrigle, M., Concannon, C., Clenaghan, C., Cunningham, P., Delaney, J., O'Boyle, S., MacCa'rthaigh, M., Craig, M. & Quinn, R. (2005). Water quality in Ireland, 2001 2003. Wexford. Environmental Protection Agency.

Wyse Jackson, M., FitzPatrick, Ú., Cole, E., Jebb, M., McFerran, D., Sheehy Skeffington, M. & Wright, M. (2016). Ireland Red List No. 10: Vascular Plants. National Parks and Wildlife Service, Department of Arts, Heritage, Regional, Rural and Gaeltacht Affairs, Dublin, Ireland.



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