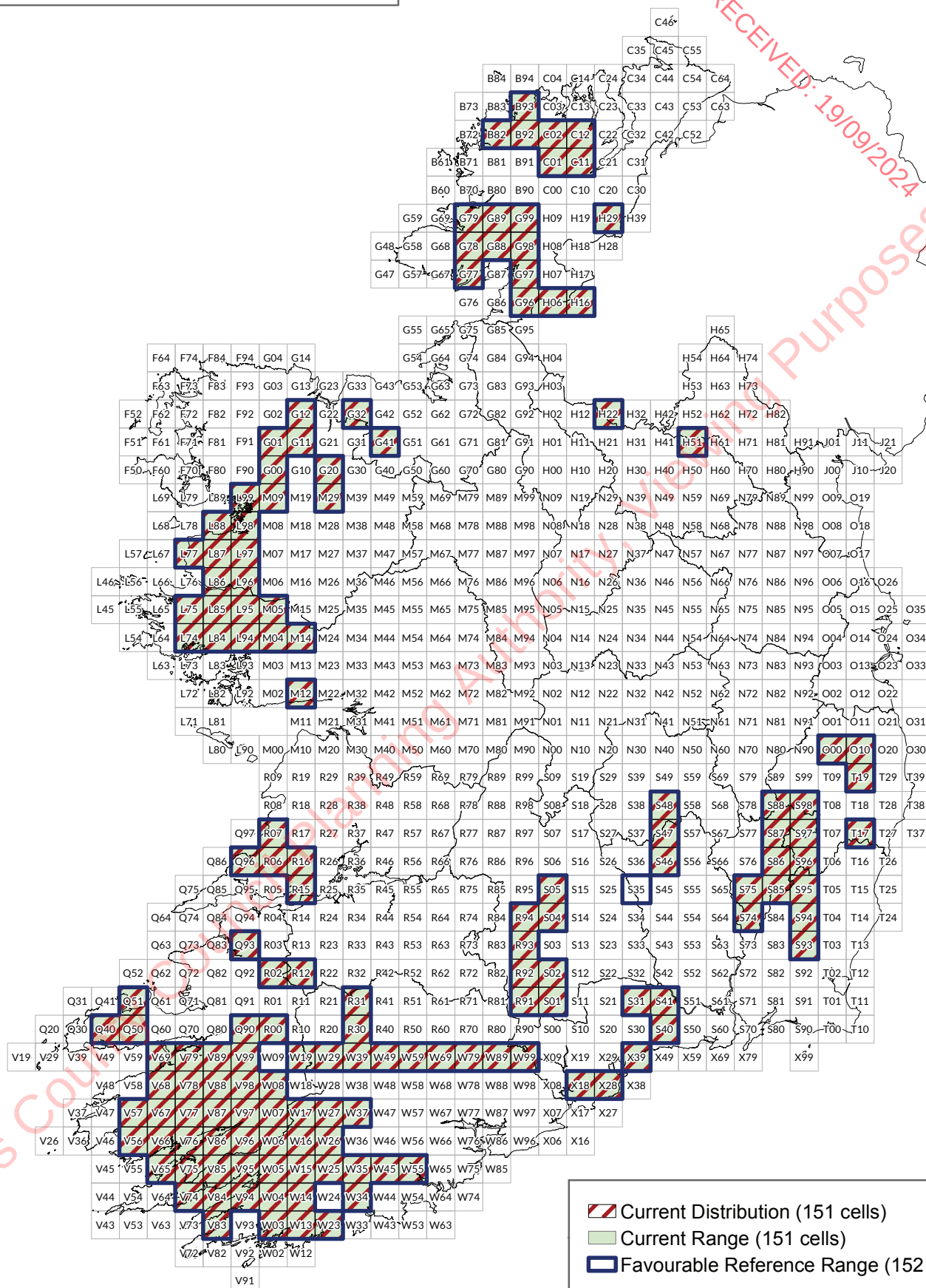


Freshwater Pearl Mussel *Margaritifera margaritifera* (1029) Article 17 (2013 - 2018) Assessment



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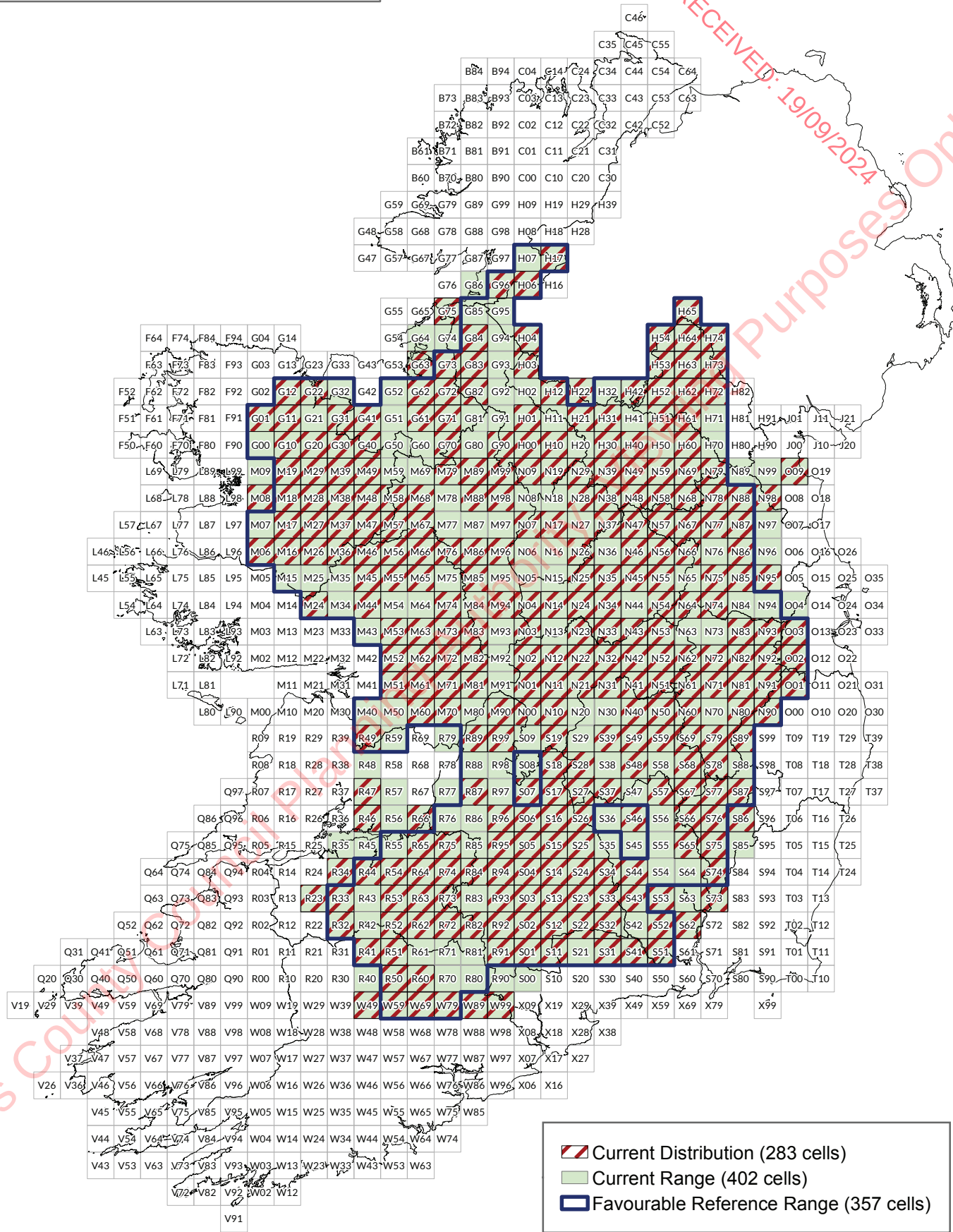
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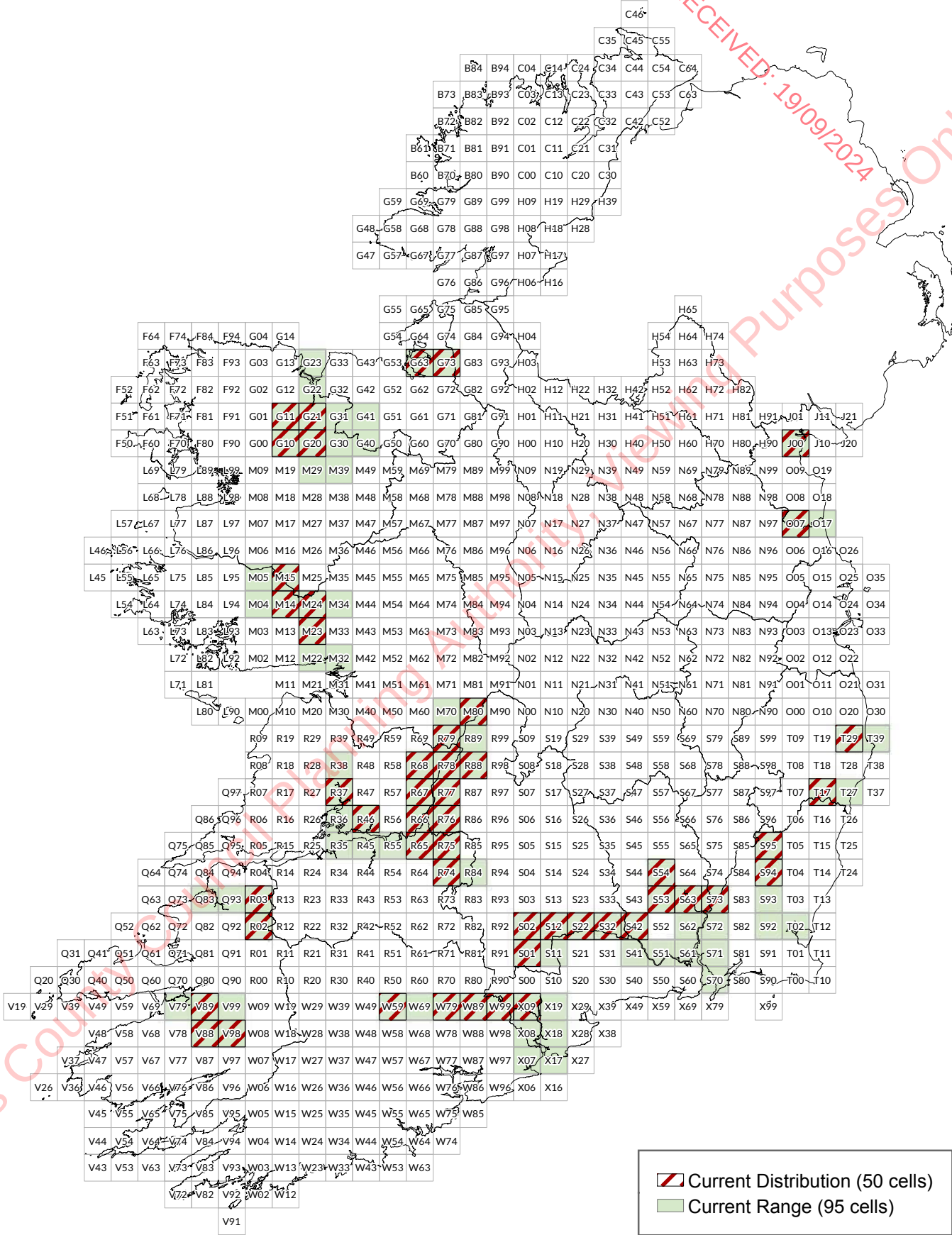
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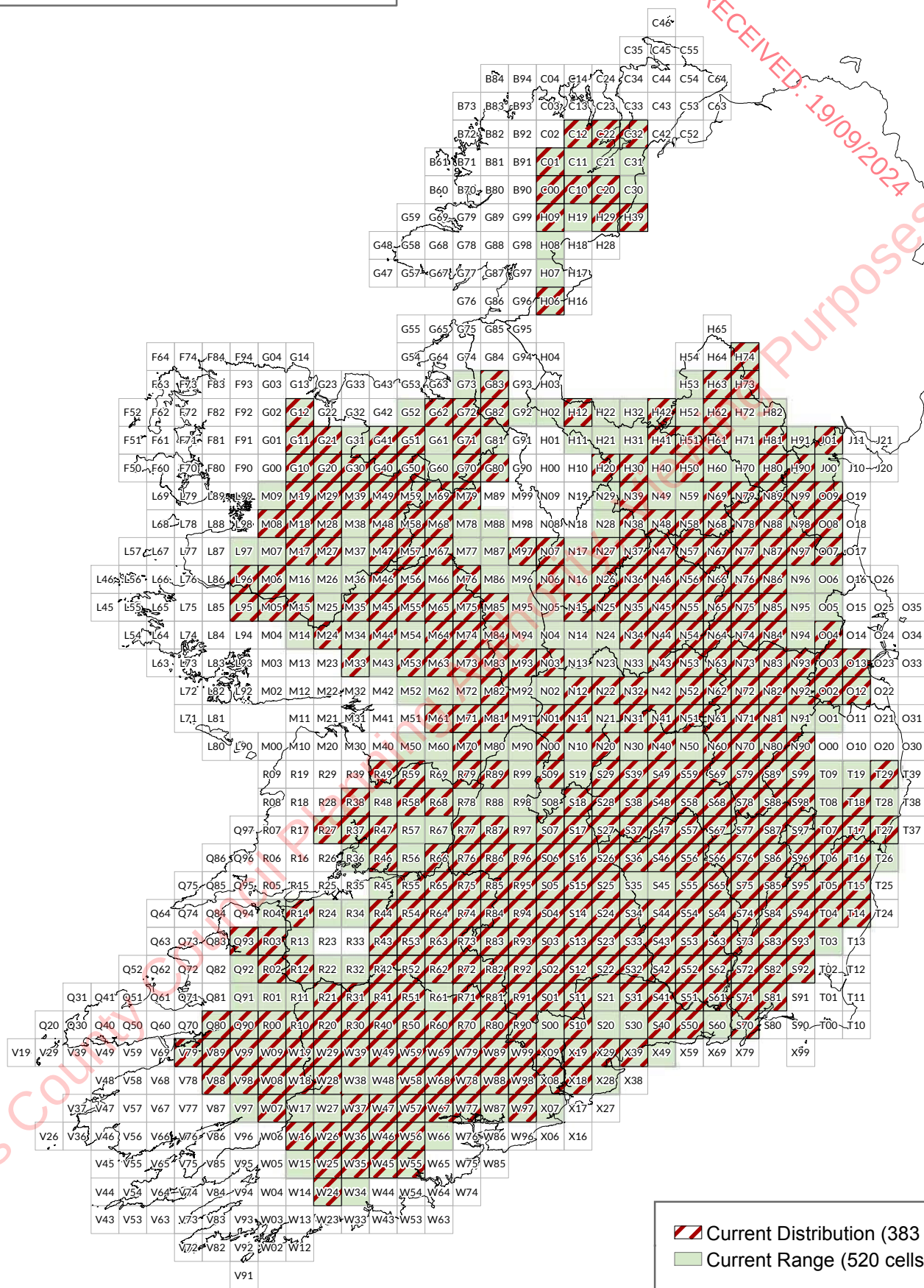
White-clawed Crayfish *Austropotamobius pallipes* (1092) Article 17 (2013 - 2018) Assessment



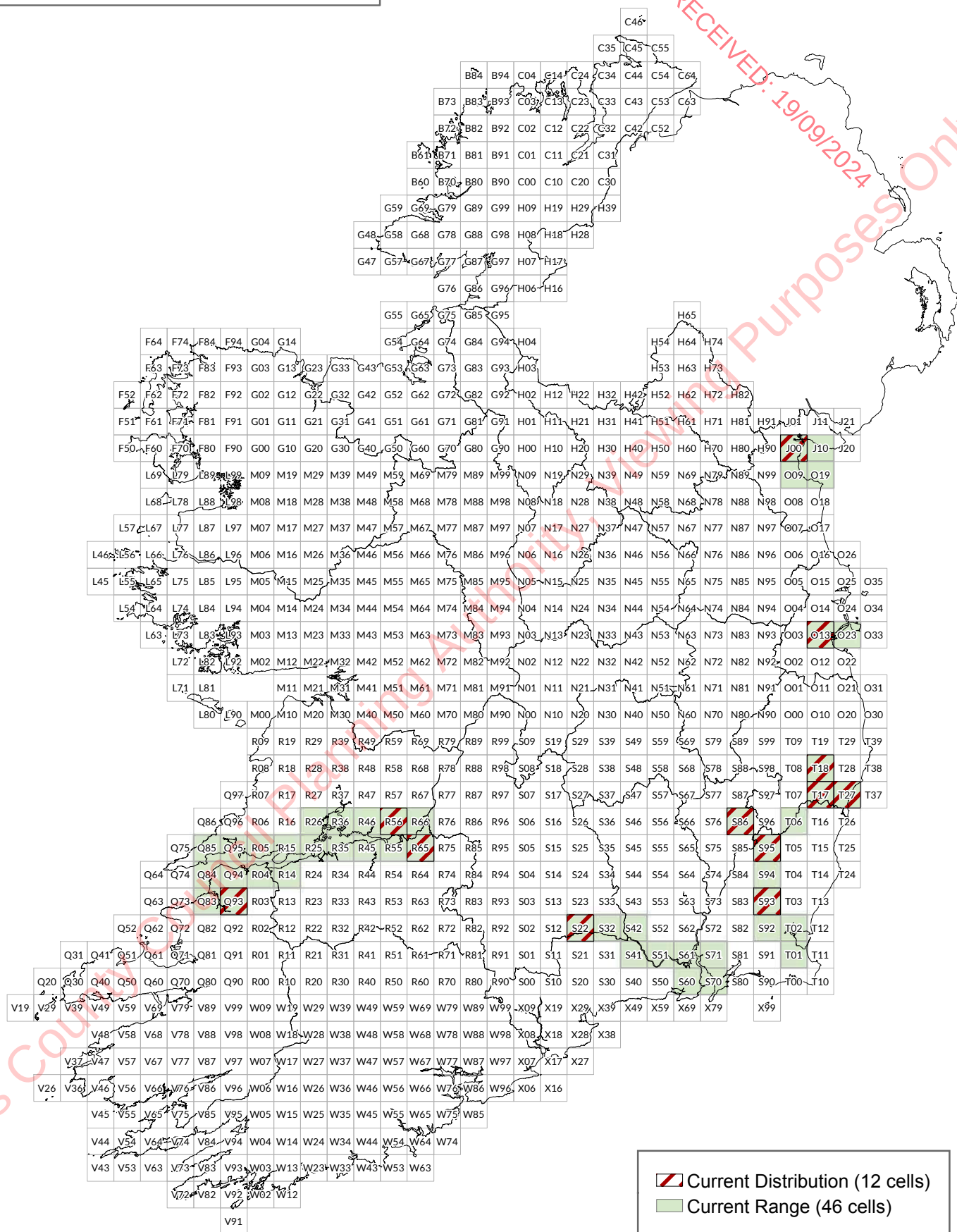
Sea lamprey *Petromyzon marinus* (1095) Article 17 (2013 - 2018) Assessment



Brook lamprey *Lampetra planeri* (1096) Article 17 (2013 - 2018) Assessment



River lamprey *Lampetra fluviatilis* (1099) Article 17 (2013 - 2018) Assessment



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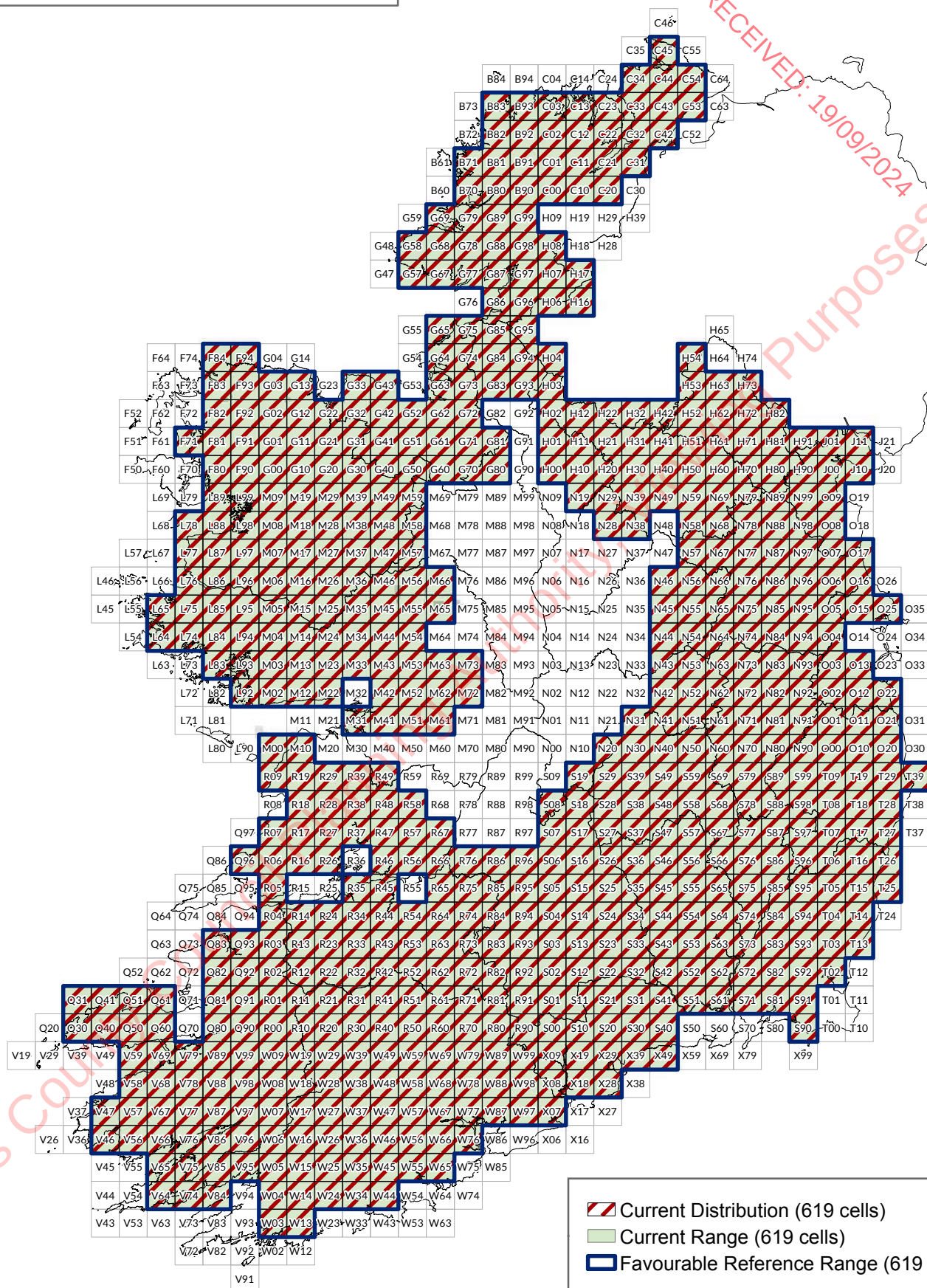
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Atlantic Salmon *Salmo salar* (1106) Article 17 (2013 - 2018) Assessment



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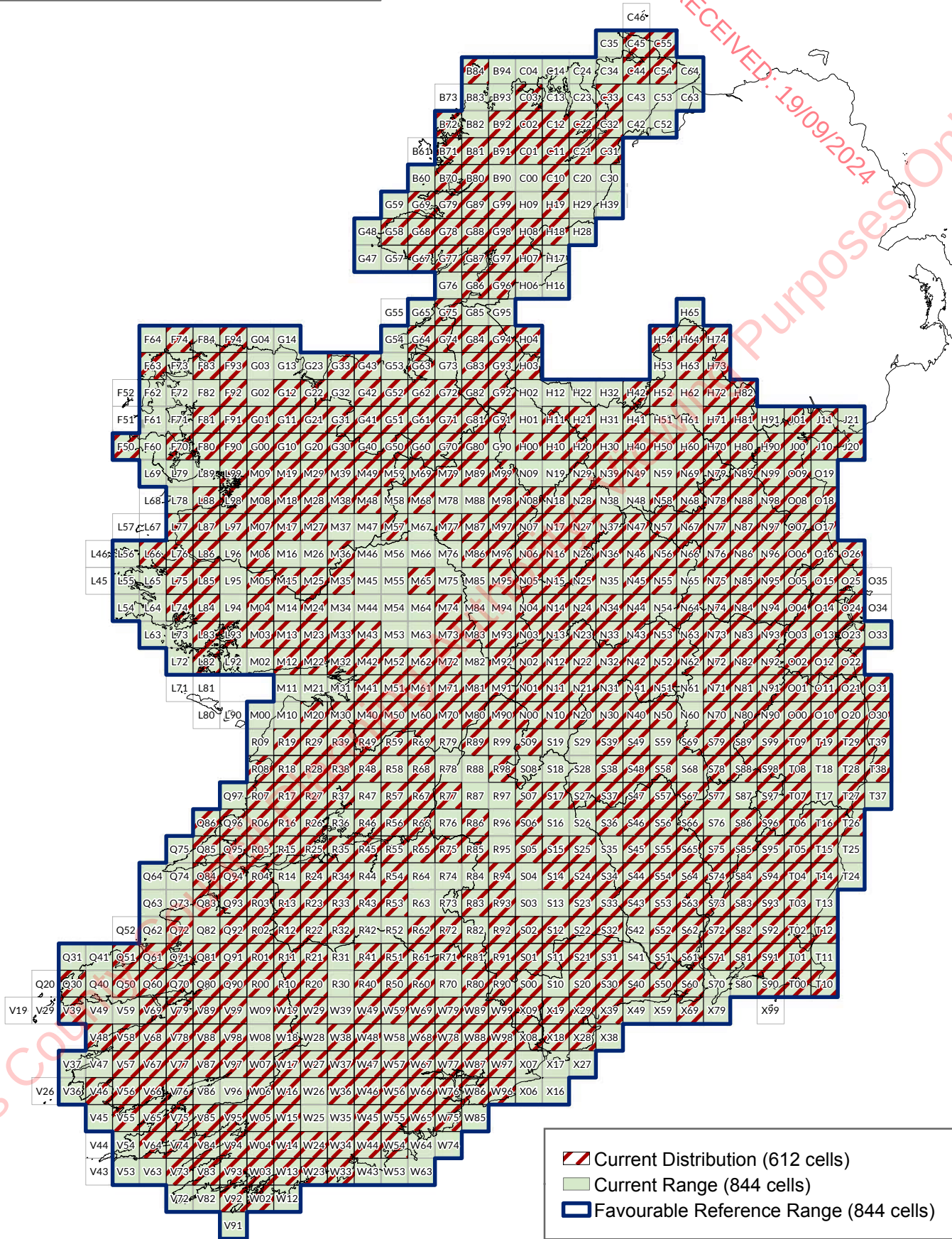
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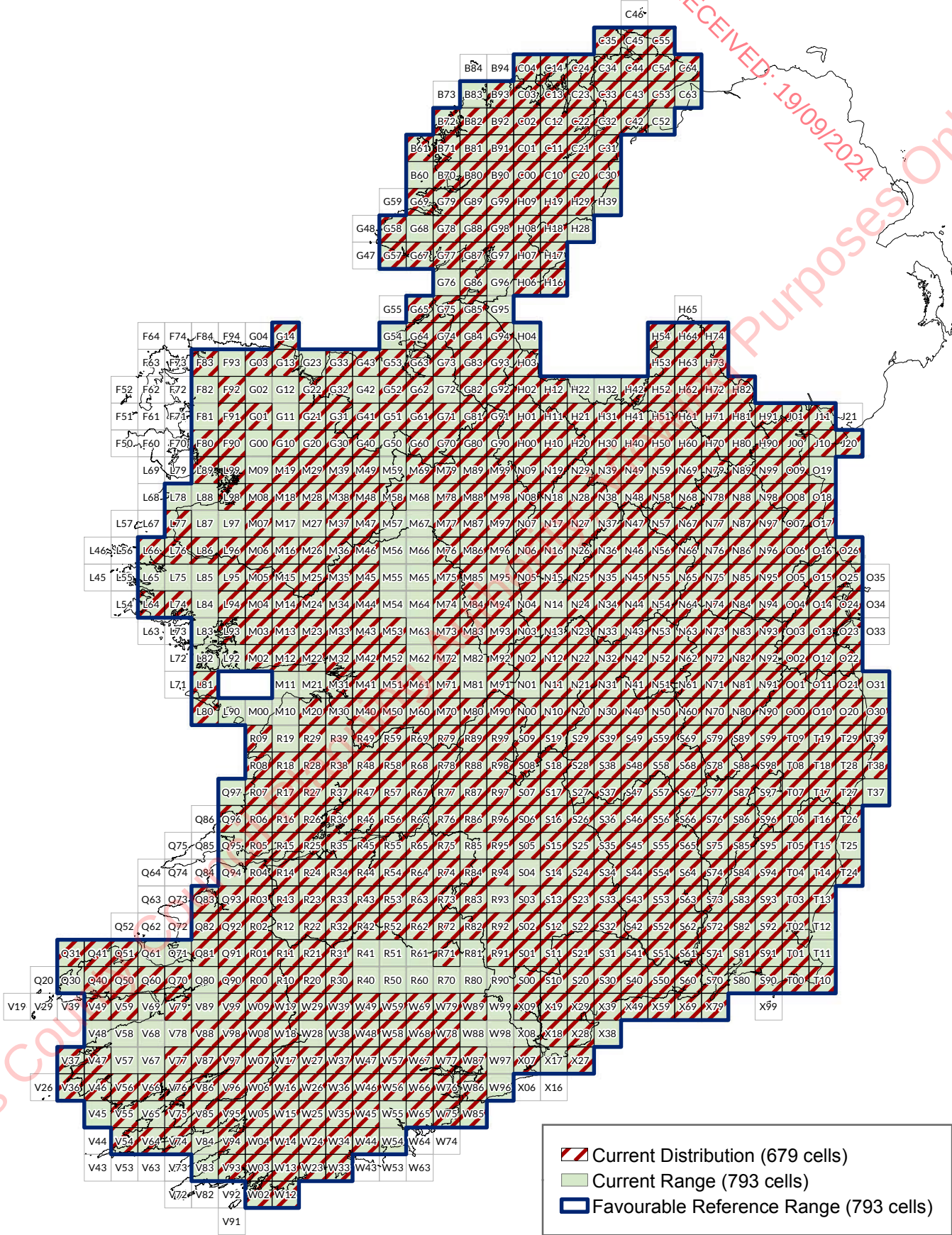
Common frog

Rana temporaria (1213)

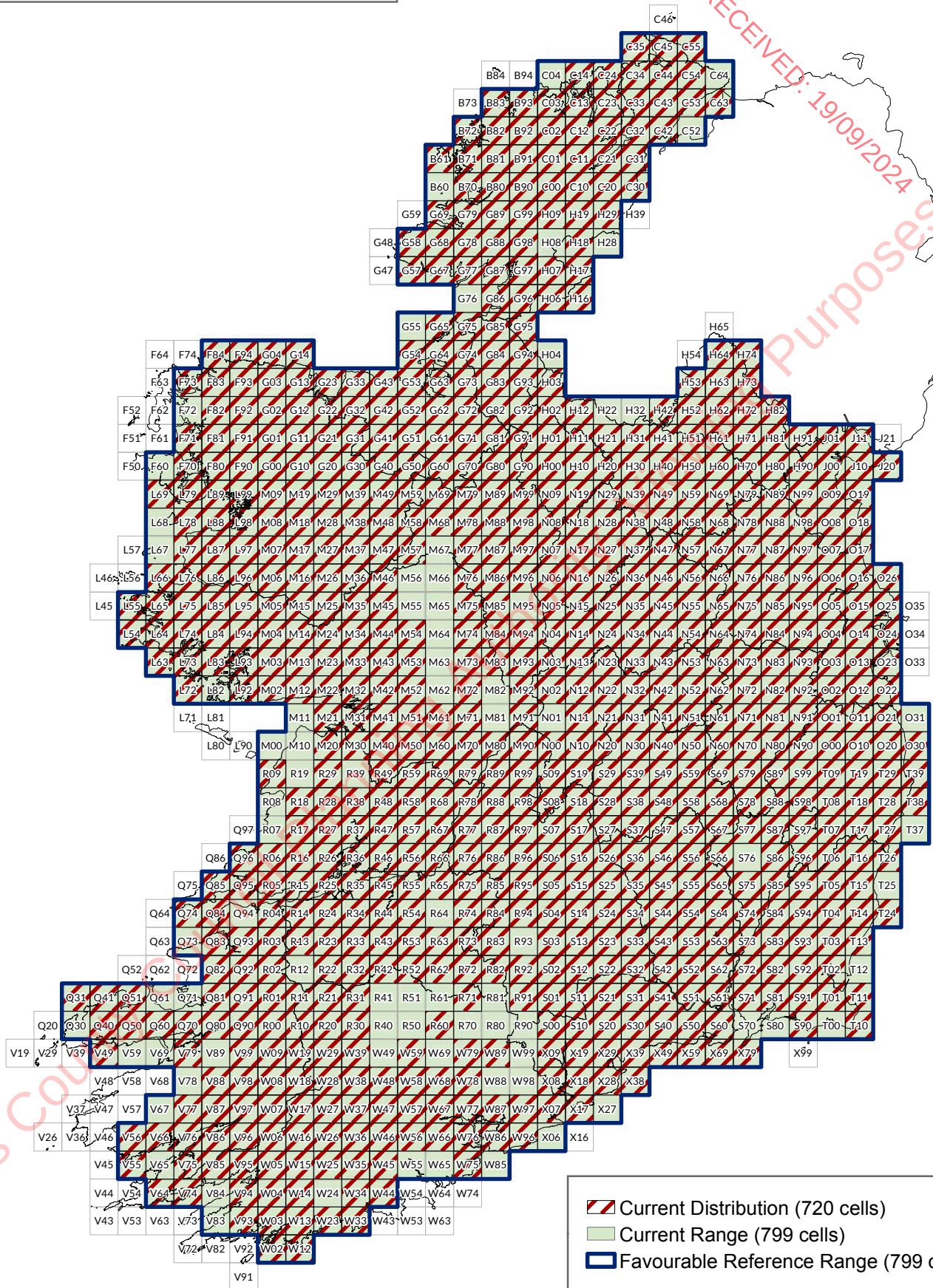
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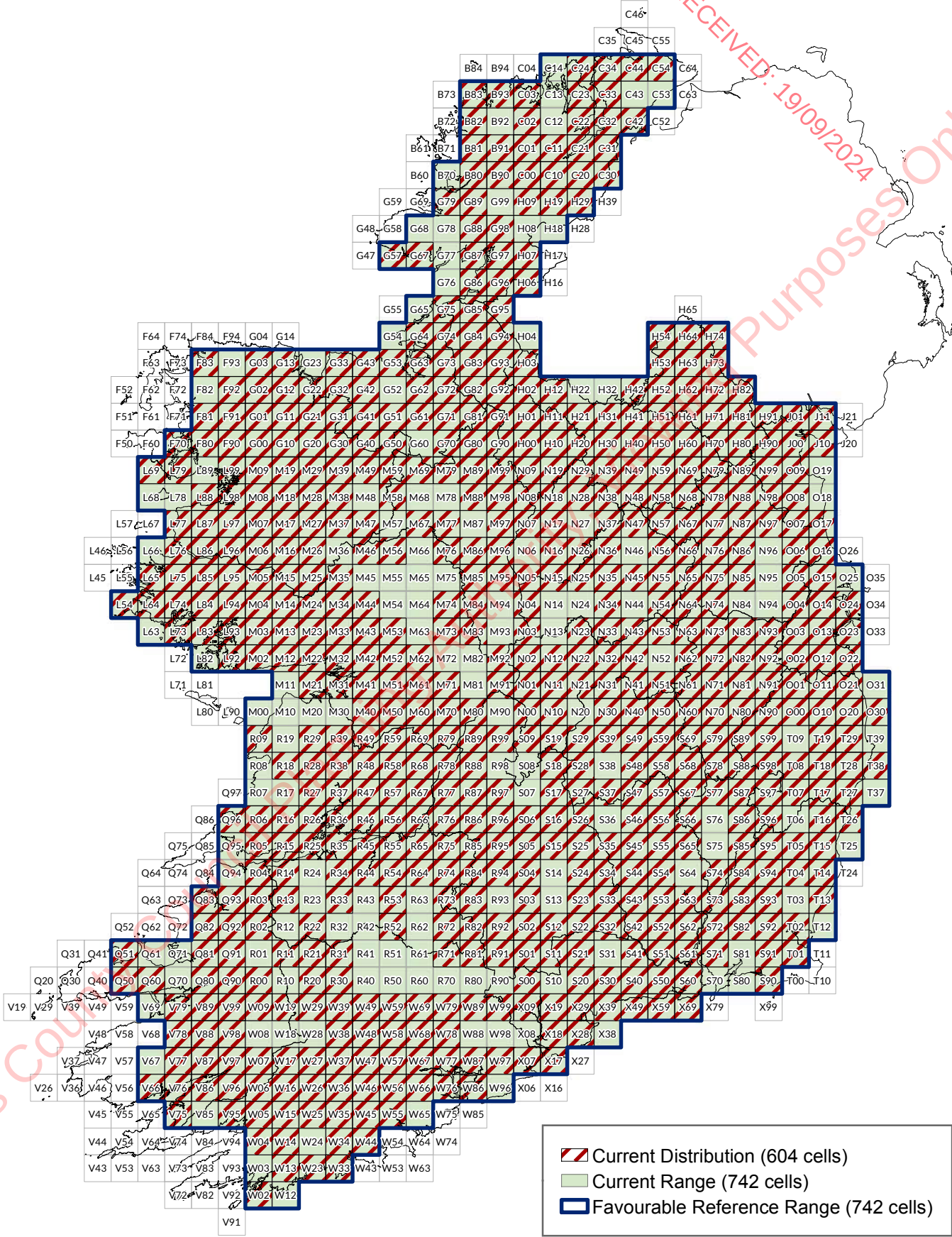
Common Pipistrelle
Pipistrellus pipistrellus (1309)
Article 17 (2013 - 2018) Assessment



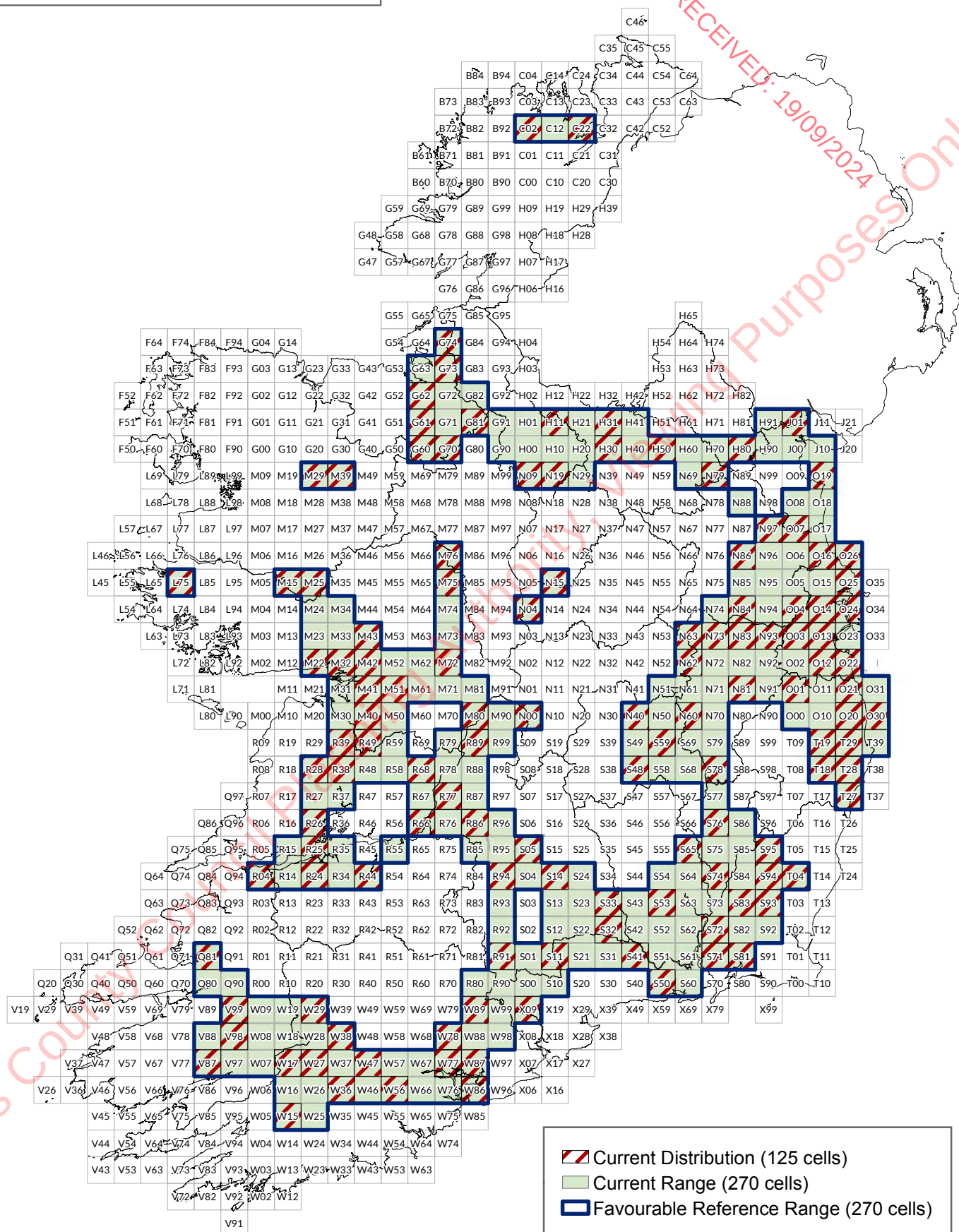
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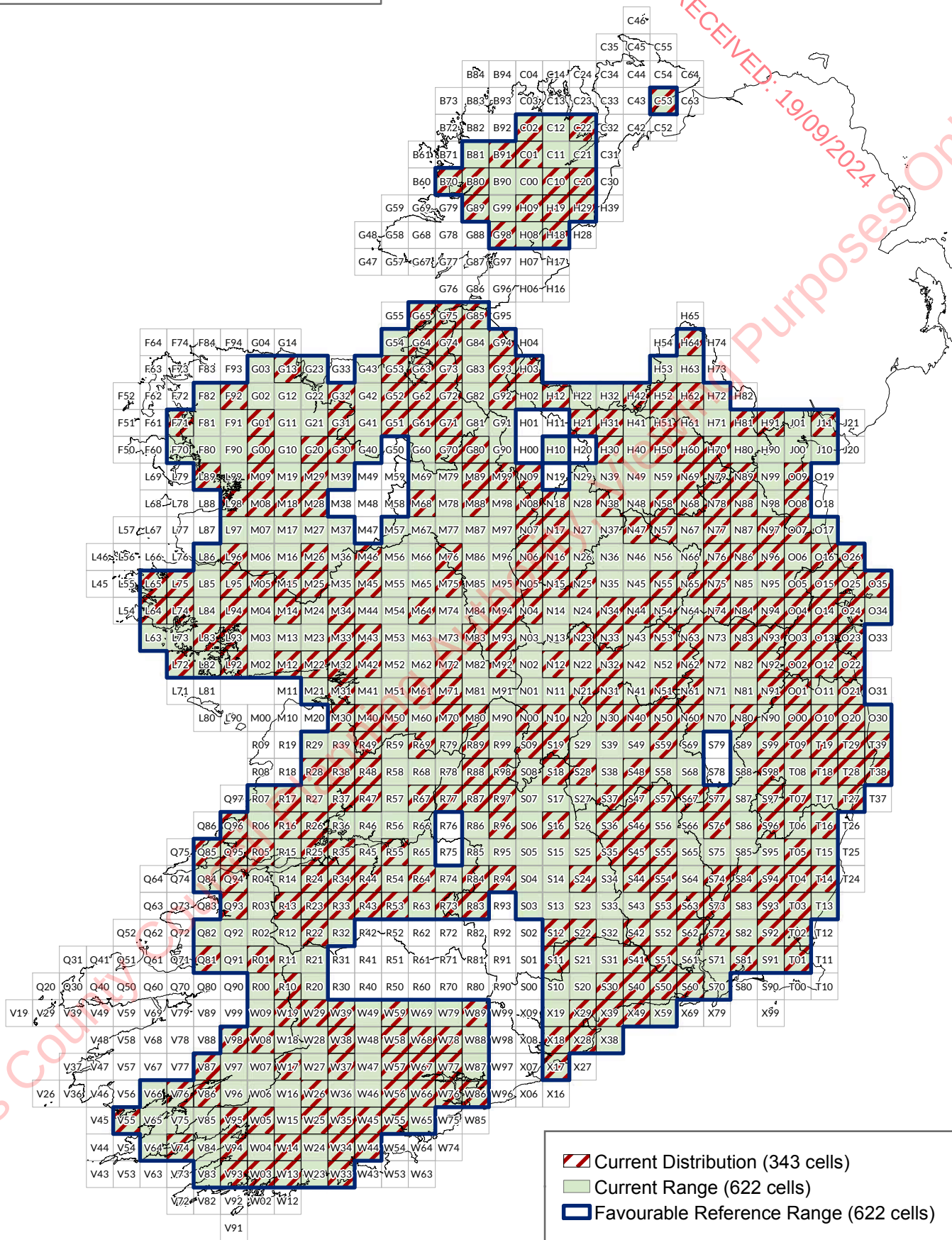
Daubenton's Ba t
Myotis daubentonii (1314)
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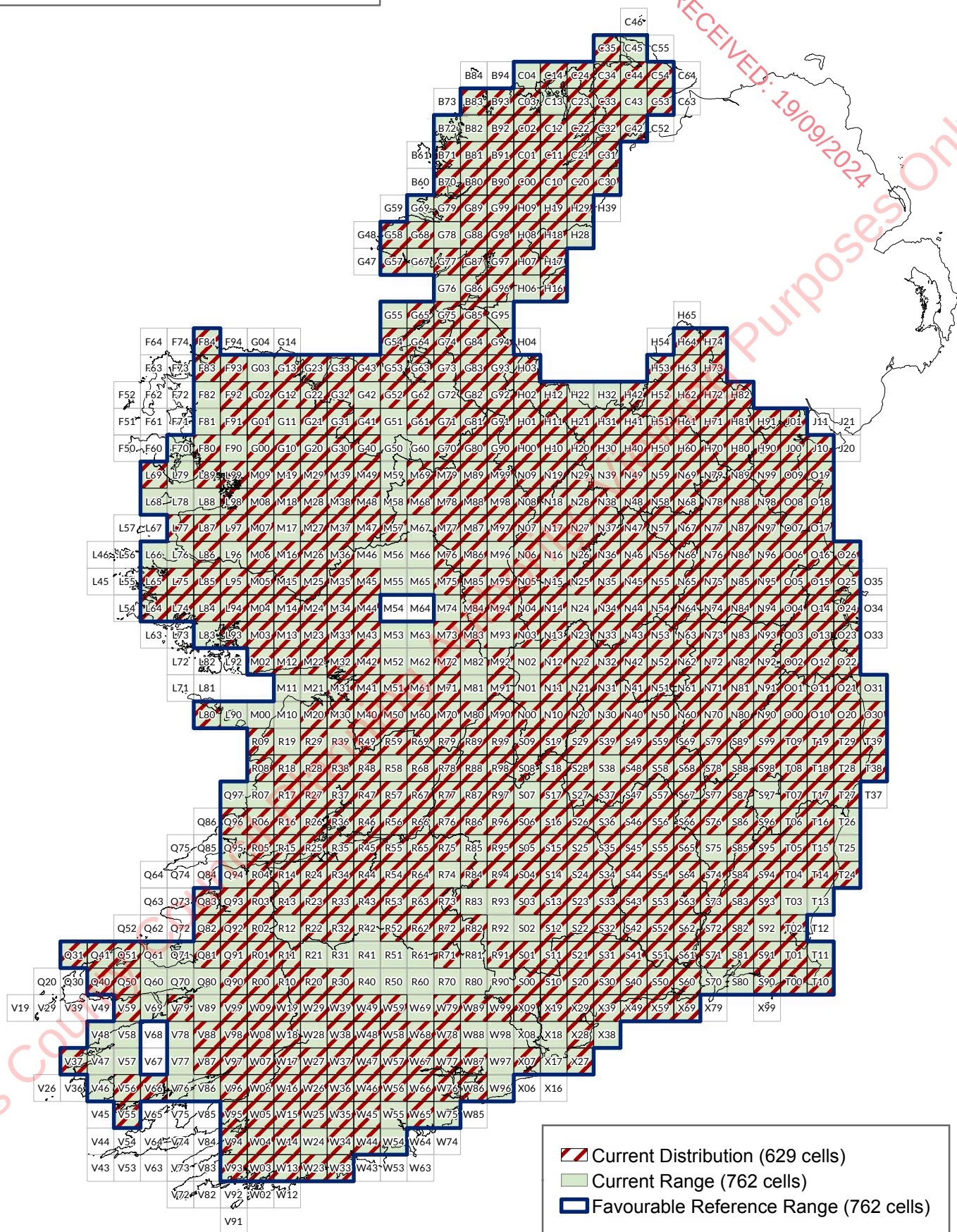
Whiskered Bat *Myotis mystacinus* (1330) Article 17 (2013 - 2018) Assessment



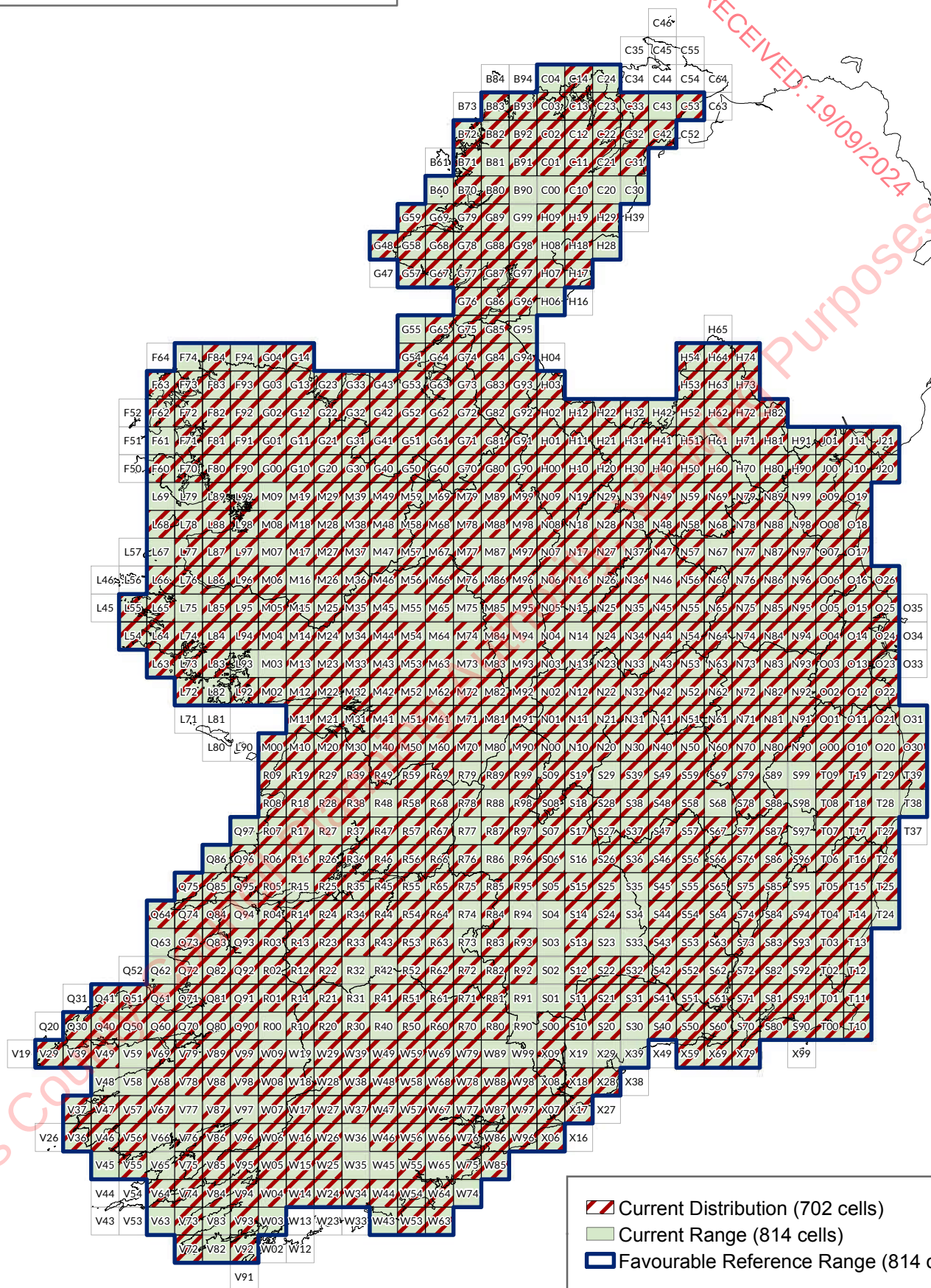
Brown long-eared Bat *Plecotus auritus* (1326) Article 17 (2013 - 2018) Assessment



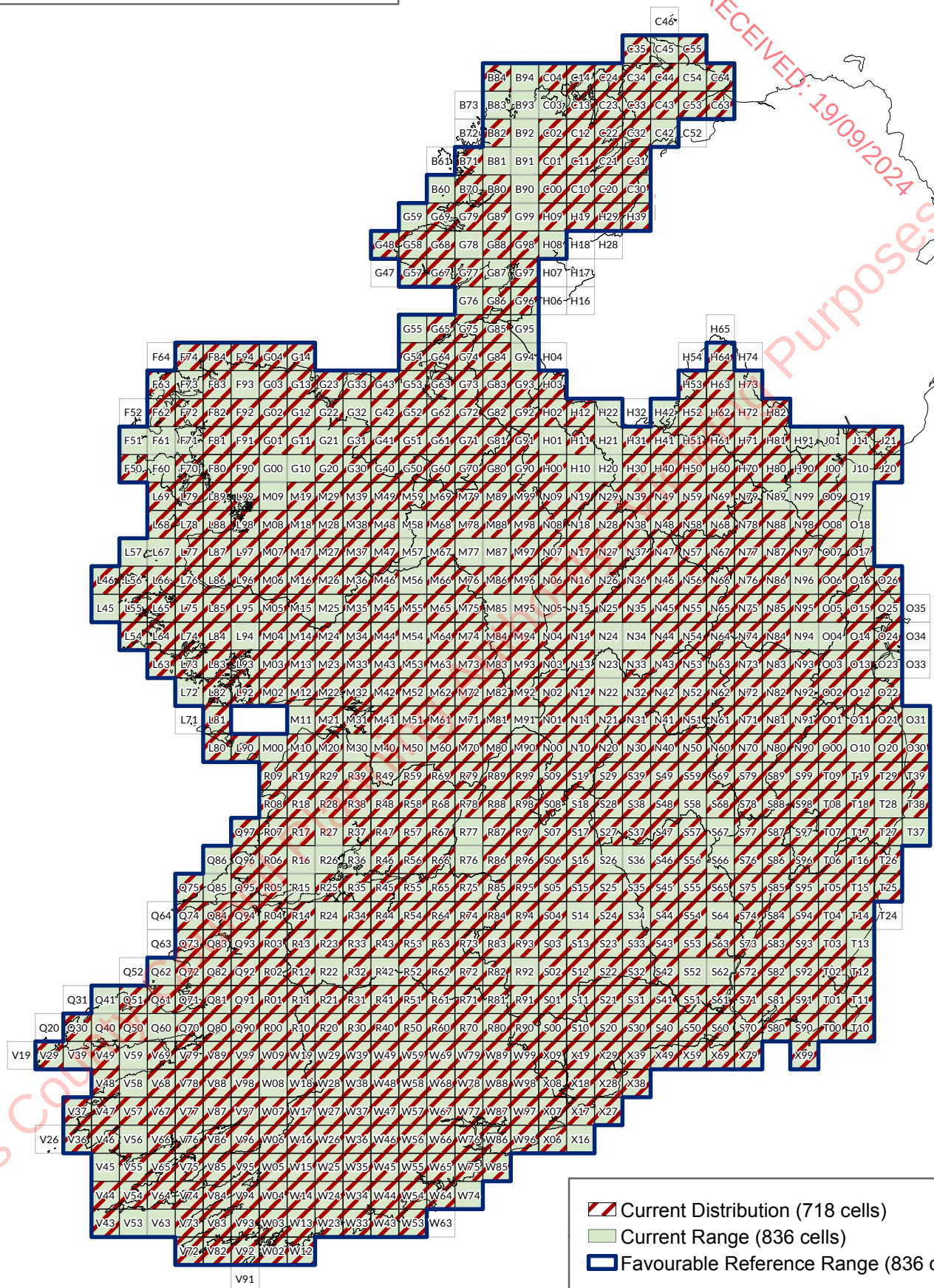
Leisler's Bat
Nyctalus leisleri (1331)
Article 17 (2013 - 2018) Assessment



Irish Hare *Lepus timidus* (1334) Article 17 (2013 - 2018) Assessment



Otter
Lutra lutra (1355)
 Article 17 (2013 - 2018) Assessment



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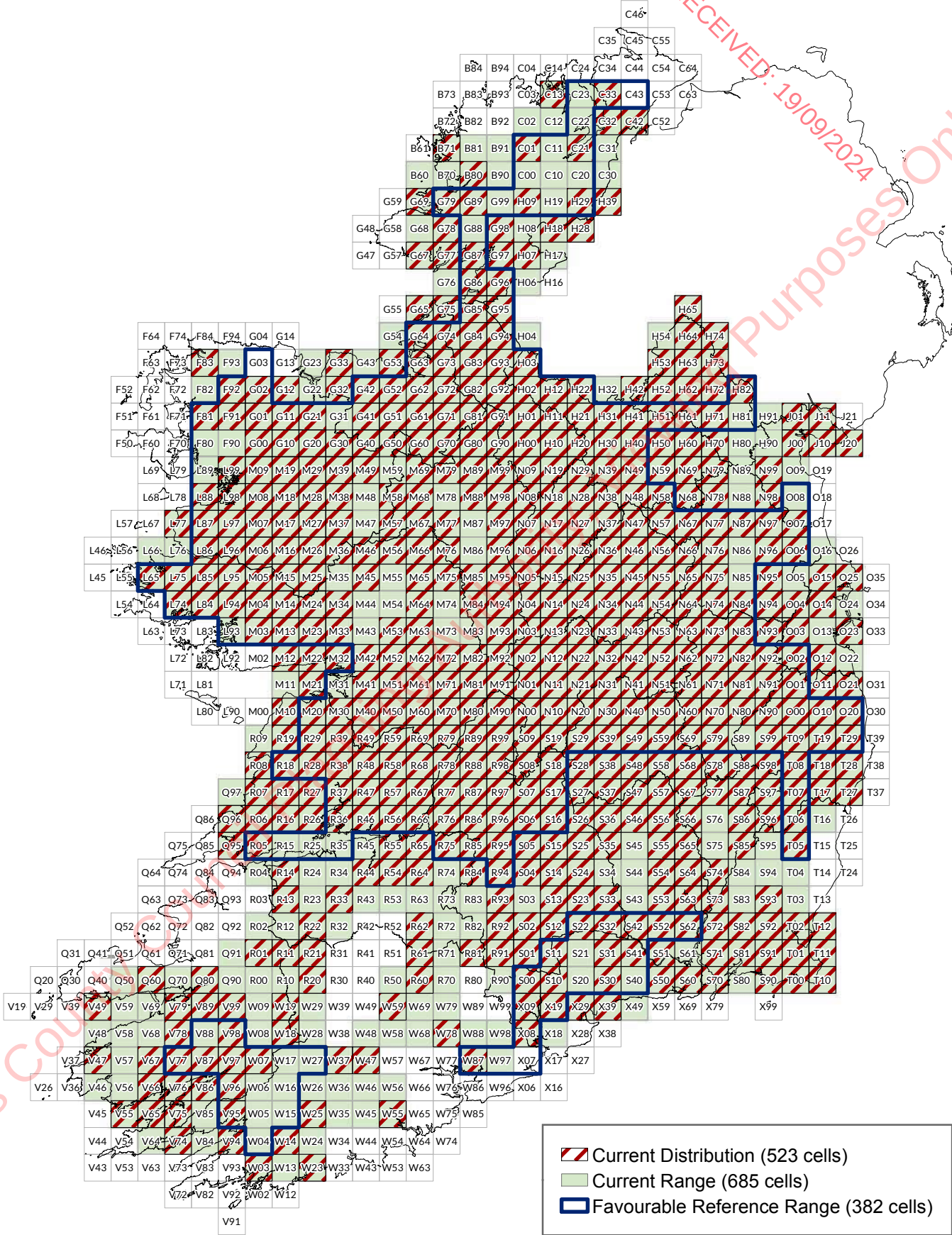
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Pine Marten

Martes martes (1357)

Article 17 (2013 - 2018) Assessment



Appendix 5-H

Aquatic & Fisheries Baseline Report

RECEIVED 19/09/2024

Laois County Council Planning Authority, Viewing Purposes Only

Aquatic & fisheries baseline report for the continued operation and development of a quarry at Mounthall, Co. Laois



Prepared by Triturus Environmental Ltd. for Breedon Ireland

August 2024

Please cite as:

Triturus (2024). Aquatic & fisheries baseline report for the continued operation and development of a quarry at Mounthall, Co. Laois. Report prepared by Triturus Environmental Ltd. for Breedon Ireland. August 2024.

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1. Introduction

1.1 Background

Triturus Environmental Ltd. were commissioned by SLR Ireland Ltd. on behalf of Breedon Materials Ltd. trading as Breedon Ireland (hereafter Breedon Ireland) to conduct baseline aquatic and fisheries surveys to inform the EIAR and NIS preparation for the continued operation and extension of the existing quarry development at Mounthall and Cummer townlands, Co. Laois.

The existing quarry site is situated 3km north of Camross, south of the Slieve Bloom Mountains, and approximately 8km northwest of Mountrath (**Figure 2.1**). The Killeen River is situated to the east of the study area and is hydrologically connected to the River Barrow and River Nore SAC (002162) 3km downstream and southeast of the quarry (**Figure 2.1**).

The current aquatic and fisheries baseline survey would provide a detailed overview of the aquatic flora and fauna of high aquatic ecological value including the existing fisheries asset. The baseline surveys would also collate data on the contemporary biological water quality of watercourses in the catchment of the existing quarry study area.

1.2 Development description

The proposed development planning application consists of an extension to the existing permitted sand and gravel quarry including phased extraction and associated site facilities as described below. A full development description is provided in the Environmental Impact Assessment Report (EIAR) and Nature Impact Statement (NIS) report accompanying the planning submission.

- Extension to existing permitted sand and gravel pit registered under Section 261 of the Planning & Development Act 2000, as amended (site ref. QY05/10) within an overall application area of c. 12.2 hectares. The proposed development will consist of:
- Phased extraction of sand and gravel (dry working) over an area of c. 8 hectares with processing that includes crushing, washing (closed loop water recycling system with associated silt storage lagoons), screening and all ancillary works and structures;
- Site facilities consisting of mobile aggregate processing plant, weighbridge office (6.25m²), welfare facility including canteen and cloakroom (18.9m²), serviced portaloo toilet, bunded fuel storage and refuelling pad with hydrocarbon interceptor, weighbridge, wheelwash, water supply borehole, perimeter berms, vegetation planting and fencing;
- Access to the site will be via the existing Sand & Gravel Pit entrance;
- Restoration of the site to agricultural lands; and
- The proposed extraction operational period is for 10 years plus 1 year to complete restoration (total duration sought 11 years).

2. Methodology

2.1 Selection of watercourses for assessment

All of the downstream riverine sites which could be affected by the proposed development were considered as part of the current assessment. A total of $n=6$ sites in the vicinity of proposed works, inclusive of upstream controls, were selected for detailed aquatic assessment (see **Table 2.1**, **Figure 2.1** below). The nomenclature and alignments for the watercourses surveyed followed Environmental Protection Agency (EPA) mapping.

The survey sites were situated on an unmapped tributary of the Killeen River (EPA code: n/a) and the Killeen River (EPA code: 15K01)(**Table 2.1**). The aquatic survey sites were situated in the Killeen (Delour)_010 sub-basin within the Nore_SC_020 sub-catchment. The proposed quarry development was not located within a European site but did share downstream hydrological connectivity with the River Barrow and River Nore SAC (002162), situated 3km by water downstream via the Killeen River.

2.2 Aquatic site surveys

Aquatic surveys of the river sites downstream of Mounthall Quarry were conducted on the 8th July 2024. Survey effort focused on both instream and riparian habitats at each aquatic sampling location and included a fisheries assessment (electro-fishing & fisheries habitat appraisal), white-clawed crayfish survey, macrophyte survey, aquatic bryophyte survey and biological water quality sampling (Q-sampling) (**Figure 2.1**). This comprehensive approach informed the overall aquatic ecological evaluation of each site/watercourse in context of the proposed development and ensured that any habitats and species of high conservation value would be detected to best inform mitigation.

In addition to the ecological characteristics of the site, a broad aquatic and riparian habitat assessment was conducted utilising elements of 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). This broad characterisation helped define the watercourses' conformity or departure from naturalness. All sites were assessed in terms of:

- Physical watercourse/waterbody characteristics (i.e. width, depth, channel form) including associated evidence of historical drainage
- Substrate type and relative condition, listing substrate fractions in order of dominance (i.e. bedrock, boulder, cobble, gravel, sand, silt etc.)
- Substrate condition included surface deposition and infiltration levels via visual observation
- Flow type by proportion of riffle, glide and pool in the sampling area
- An appraisal of the macrophyte and aquatic bryophyte community at each site
- Riparian vegetation composition and bordering land use practices

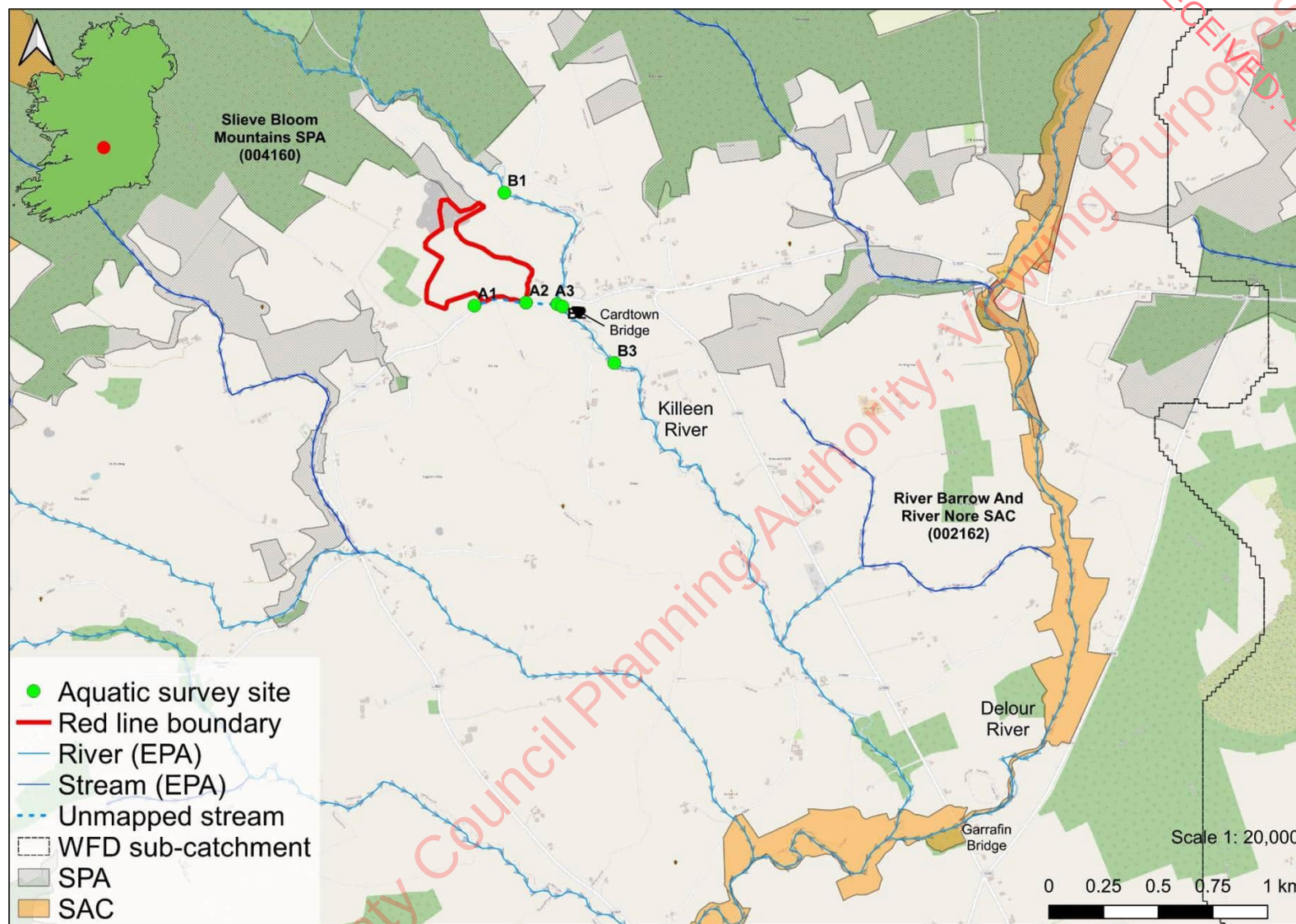


Figure 2.1 Location of the aquatic survey sites in the vicinity of the Mounthall Quarry, Co. Laois

Table 2.1 Location of the $n=6$ aquatic survey sites in the vicinity of Mounthall Quarry

Site no.	Watercourse	EPA code	Location	X (ITM)	Y (ITM)
A1	Unnamed Stream (not mapped by EPA)	n/a	Mounthall	626712	697982
A2	Unnamed Stream (not mapped by EPA)	n/a	Mounthall	626948	697996
A3	Unnamed Stream (not mapped by EPA)	n/a	Cummer	627091	697989
B1	Killeen River	15K01	Cummer	626849	698499
B2	Killeen River	15K01	Cardtown Bridge	627115	697978
B3	Killeen River	15K01	Killeen	627352	697720

2.3 Fisheries assessment (electro-fishing)

A single anode Smith-Root LR24 backpack (12V DC input; 300V, 100W DC output) was used to electro-fish sites on riverine watercourses in the vicinity of Mounthall Quarry in July 2024 following notification to Inland Fisheries Ireland and under the conditions of a Department of the Environment, Climate and Communications (DECC) licence. The electro-fishing survey was undertaken across 6 no. riverine sites (see **Table 2.1**, **Figure 2.1**).

Both river and holding tank water temperature was monitored continually throughout the survey to ensure temperatures of 20°C were not exceeded, thus minimising stress to the captured fish due to low dissolved oxygen levels. A portable battery-powered aerator was also used to further reduce stress to any captured fish contained in the holding tank. Salmonids, European eel and other captured fish species were transferred to a holding container with oxygenated fresh river water following capture. To reduce fish stress levels, anaesthesia was not applied to captured fish. All fish were measured to the nearest millimetre and released in-situ following a suitable recovery period.

As three primary species groups were targeted during the survey, i.e., salmonids, lamprey, and eel, the electro-fishing settings were tailored for each species. By undertaking electro-fishing using the rapid electro-fishing technique (see methodology below), the broad characterisation of the fish community at each sampling reach could be determined as a longer representative length of channel was surveyed. Electro-fishing methodology followed accepted European standards (CEN, 2003) and adhered to best practice (e.g., CFB, 2008).

2.3.1 Salmonids and European eel

For salmonid species and European eel, as well as all other incidental species, electro-fishing was carried out in an upstream direction for a 10-minute CPUE, an increasingly common standard approach for wadable streams (Matson et al., 2018). A total of approx. 30-50m channel length was surveyed at each site, where feasible, in order to gain a better representation of fish stock assemblages.

Relative conductivity of the water at each site was checked in-situ with a conductivity meter and the

electro-fishing backpack was energised with the appropriate voltage and frequency to provide enough draw to attract salmonids and European eel to the anode without harm. For the moderate conductivity waters of the sites a voltage of 250-300v, frequency of 35-40Hz and pulse duration of 3.5-4ms was utilised to draw fish to the anode without causing physical damage.

2.3.2 Lamprey

Electro-fishing for lamprey ammocoetes was conducted using targeted quadrat-based electro-fishing (as per Harvey & Cowx, 2003) in objectively suitable areas of sand/silt, where encountered. As lamprey take longer to emerge from silts and require a more persistent approach, they were targeted at a lower frequency (30Hz) burst DC pulse setting which also allowed detection of European eel in sediment, if present. Settings for lamprey followed those recommended and used by Harvey & Cowx (2003), APEM (2004) and Niven & McAuley (2013). Using this approach, the anode was placed under the water's surface, 10-15cm above the sediment, to prevent immobilising lamprey ammocoetes within the sediment. The anode was energised with 100V of pulsed DC for 15-20 seconds and then turned off for approximately five seconds to allow ammocoetes to emerge from their burrows. The anode was switched on and off in this way for approximately two minutes. Immobilised ammocoetes were collected by a second operator using a fine-mesh hand net as they emerged.

Lamprey species were identified to species level, where possible, with the assistance of a hand lens, through external pigmentation patterns and trunk myomere counts as described by Potter & Osborne (1975) and Gardiner (2003).

2.4 Fisheries habitat appraisal

A fisheries habitat appraisal of all survey sites was undertaken to establish the importance of the supporting habitats as nursery, spawning and or holding habitats for salmonids and lamprey species but also considered European eel and other fish species. The appraisals of salmonids and lamprey were cognisant of species-specific habitat requirements and preferences as outlined in O'Grady (2006), Hendry et al. (2003), Armstrong et al. (2003), Harvey & Cowx (2003), Maitland (2003) and Hendry & Cragg-Hine (1997). River habitat surveys and fisheries assessments were also conducted utilising elements of the approaches in the River Habitat Survey Methodology (Environment Agency, 2003) and Fishery Assessment Methodology (O'Grady, 2006) to broadly characterise the riverine sites (i.e., channel profiles, substrata etc.).

2.5 Biological water quality (Q-sampling)

The 6 no. riverine survey sites were assessed for biological water quality through Q-sampling on the 8th July 2024 (**Table 2.1**). All samples were taken with a standard kick sampling hand net (250mm width, 500µm mesh size) from areas of riffle/glide using a 2-minute kick sample, as per Environmental Protection Authority (EPA) methodology (Feeley et al., 2020). Large cobble was also washed at each site for 1-minute (where present) to collect attached macro-invertebrates (as per Feeley et al., 2020). Samples were elutriated and fixed in 70% ethanol for subsequent laboratory identification to species level. Samples were converted to Q-ratings as per Toner et al. (2005) and assigned to WFD status classes (**Table 2.2**). Any rare invertebrate species were identified from the NPWS Red List publications

for beetles (Foster et al., 2009), mayflies (Kelly-Quinn & Regan, 2012), stoneflies (Feeley et al., 2020) and other relevant taxa (i.e. Byrne et al., 2009; Nelson et al., 2011).

Table 2.2 Reference categories for EPA Q-ratings (Q1 to Q5) (Toner et al., 2005)

Q value	WFD status	Pollution status	Condition
Q5 or Q4-5	High status	Unpolluted	Satisfactory
Q4	Good status	Unpolluted	Satisfactory
Q3-4	Moderate status	Slightly polluted	Unsatisfactory
Q3 or Q2-3	Poor status	Moderately polluted	Unsatisfactory
Q2, Q1-2 or Q1	Bad status	Seriously polluted	Unsatisfactory

2.6 Macrophytes and aquatic bryophytes

Surveys of the macrophyte and aquatic bryophyte community were conducted by instream wading at each of the survey sites, with specimens collected (by hand or via grapnel) for on-site identification. An assessment of the aquatic vegetation community helped to identify any rare macrophyte species listed under the Flora (Protection) Order, 2022 and or Irish Red list for vascular plants (Wyse-Jackson et al., 2016) or habitats corresponding to the Annex I habitats, e.g., 'Water courses of plain to montane levels, with submerged or floating vegetation of the *Ranunculum fluitantis* and *Callitriche-Batrachion* (low water level during summer) or aquatic mosses [3260]' (more commonly referred to as 'floating river vegetation').

2.7 Biosecurity

A strict biosecurity protocol following IFI (2010) and the Check-Clean-Dry approach was adhered to during surveys for all equipment and PPE used. Disinfection of all equipment and PPE before and after use with Virkon™ was conducted to prevent the transfer of pathogens or invasive propagules between survey sites. Surveys were undertaken at sites in a downstream order to minimise the risk of upstream invasive propagule mobilisation. Any aquatic invasive species or pathogens recorded within or adjoining the survey areas were geo-referenced. All Triturus staff are certified in 'Good fieldwork practice: slowing the spread of invasive non-native species' by the University of Leeds.

3. Desktop review

3.1 Fisheries

The River Nore catchment drains an area of 2,597km² and is approximately 134km in length from source to sea flowing through counties Tipperary, Laois and Kilkenny (Gordon et al. 2021). The River Barrow and River Nore SAC (002162) is designated for five fish species (NPWS, 2021), namely; Sea lamprey (*Petromyzon marinus*) [1095], Brook lamprey (*Lampetra planeri*) [1096], River lamprey (*Lampetra fluviatilis*) [1099], Twaite shad (*Alosa fallax*) [1103] and Atlantic salmon (*Salmo salar*) [1106].

The Nore is ranked 4th in Ireland with regards to fluvial accessible habitat to salmon with 6% of the national total (McGinnity et al., 2003). However, the wider Nore catchment has a high number of instream barriers (AMBER Consortium, 2020; Gargan et al., 2011) that restrict the passage of migratory fish species.

Fisheries data for the Delour River (EPA code: 15D01) was lacking at the time of survey. However, the Delour River is known to support *Lampetra* sp. upstream of the Basin weir (Gallagher et al., 2020) in addition to Atlantic salmon and brown trout (Triturus, 2022).

3.2 Water Quality

The Killeen River had good status (**Q4**) biological water quality when most recently recorded at 2022 at Cardtown Bridge (Station RS15K010200), 0.5km southeast of the existing quarry. At EPA station RS15K010400, at a bridge upstream of the Delour River confluence on the Killeen River, biological water quality was recorded as (**Q4-5**) high status in 2005 but no more recent water quality data was available.

4. Results of aquatic surveys

The following section summarises each of the $n=6$ survey sites in terms of aquatic habitats, physical characteristics and overall value for fish and macrophyte/aquatic bryophyte communities. Biological water quality (Q-sample) results are also summarised for each riverine sampling site and in **Appendix A**. A summary of the fish species recorded at each survey site is provided in **Tables 4.1 and 4.2**. A summary of the aquatic species and habitats of high conservation concern recorded during the surveys is provided in **Table 4.3**. Habitat codes are according to Fossitt (2000). Scientific names are provided at first mention only. Sites were surveyed in July 2024.

4.1 Aquatic survey sites

4.1.1 Site A1 – Unnamed Stream

Site A1 was situated on a small upland eroding spate stream tributary of the Killeen River that flowed eastwards south of the quarry sites and formed a confluence with the Killeen River upstream of Cardtown Bridge. The stream at site A1 was 1.5m wide and between 0.1-0.2m deep with 0.5-1.5m high banks being higher on the south bank. The channel had semi-natural meandering profile through grey willow (*Salix cinerea* sp. *oleifolia*), alder (*Alnus glutinosa*) and hazel (*Corylus avellana*) mixed broadleaved woodland pockets (WD1). The bed comprised of abundant small boulder, occasional cobble and mixed gravels between rocky outcrops with exposed coarse substrata throughout. The bed also had high siltation with evident infiltration and expanses of silt in depositing areas. The stream supported occasional fool's watercress (*Apium nodiflorum*), brooklime (*Veronica beccabunga*) and water mint (*Mentha aquatica*) amongst muddy areas of the stream margin. The exposed boulder tops instream supported frequent *Brachythecium rivulare* with submerged rocks supporting occasional *Rhynchostegium riparioides*. No filamentous green algae was observed, due to the high shading. However, floc (clumped masses of decaying algae and inorganic particles) cover was c. 30%. The stream was bordered by mixed broadleaved woodland pockets (WD1) and also wet pasture (GA1). Evident cattle poaching and soil erosion was evident at the downstream extent of the survey section that was contributing to high siltation and enrichment.

The stream was considered a moderate quality nursery given broken riffle and glide with abundant rocky refugia to support young of the year fish (0+). Spawning quality was moderate for brown trout given the presence of mixed gravels but was reduced given siltation and enrichment pressures. The presence of a low density ($n=6$) brown trout population supported the stream's value as a nursery and spawning area. The stream was of too high energy to support lamprey and the species was not recorded present. While the stream had moderate quality for European eel (i.e. abundant rocky refugia and shading), the very shallow depth of the stream, small size and limited pool habitat are negative determinants of optimal eel habitat. Furthermore, known downstream significant barriers in the Nore catchment also contributed to poor upstream passage for eel (none recorded present).

Biological water quality, based on Q-sampling, was calculated as **Q3-4 (moderate status)** (**Appendix A**). No macro-invertebrate species of conservation value greater than 'least concern,' according to national red lists, were recorded via Q-sampling.

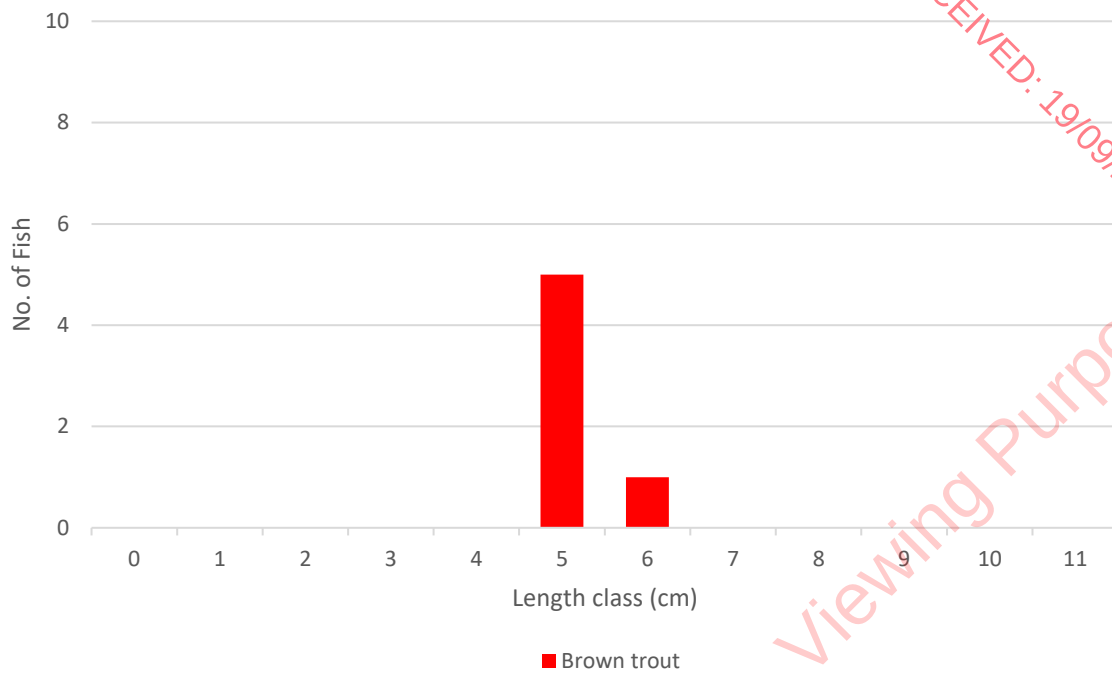


Figure 4.1 Length frequency distribution of brown trout recorded at site A1 the on unnamed tributary of the Killeen River



Plate 4.1 Representative image of the unnamed tributary of the Killeen River (Site A1)



Plate 4.2 Juvenile brown trout captured during electro-fishing from site A1 on the unnamed tributary of the Killeen River

4.1.2 Site A2 – Unnamed Stream

Site A2 was situated the unnamed stream tributary of the Killeen River downstream of site A1. As with upstream the watercourse was represented by a small upland eroding spate stream (FW1). The stream was 1m wide and between 0.1-0.15m deep with 2m high banks. The channel had semi-natural meandering profile through adjoining woodland. The stream was historically realigned along the local road. The bed comprised of frequent small boulder, occasional cobble and mixed gravels between rocky outcrops as with site A1 upstream. The bed also had high siltation with evident infiltration into the bed with localised pockets of shallow silt in pool habitat. The stream supported no macrophytes due to shading by mature trees. The exposed boulder tops instream supported occasional *Brachythecium rivulare* with submerged boulders supporting occasional *Rhynchostegium riparioides*. No filamentous green algae was observed, due to the high shading. The stream was bordered by mature hazel woodland (WN2) that overshadowed the stream.

The stream was considered a moderate quality nursery given broken riffle and glide with abundant rocky refugia for young of the year fish (0+). Spawning quality was moderate given the presence of mixed gravels but was reduced given siltation and enrichment pressures. The presence of a low density ($n=11$) brown trout population supported the streams value as a nursery and spawning area. The stream was of too high energy to support lamprey and the species was not recorded present. While the stream had moderate quality for European eel (i.e. abundant rocky refugia and shading), the very shallow depth of the stream, small size and limited pool habitat may account for the species absence. Furthermore, known downstream significant barriers in the Nore catchment also contributed to poor upstream passage for eel.

Biological water quality, based on Q-sampling, was calculated as **Q3-4 (moderate status)** (Appendix A). No macro-invertebrate species of conservation value greater than 'least concern,' according to national red lists, were recorded via Q-sampling.

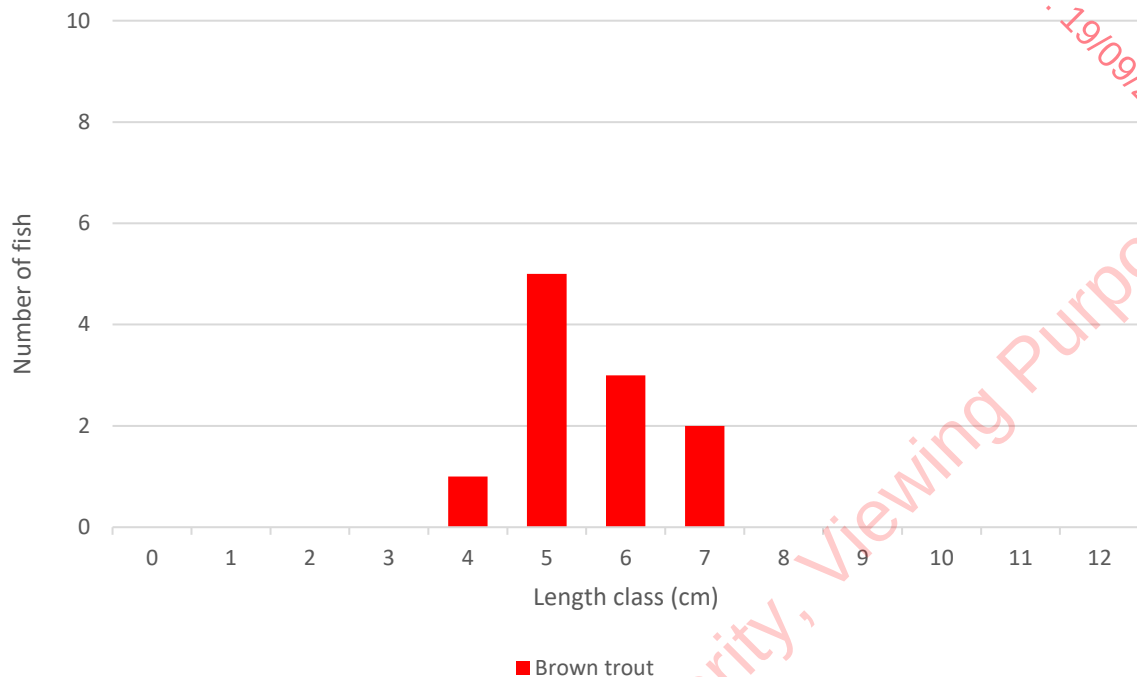


Figure 4.2 Length frequency distribution of fish recorded at site A2 on the unnamed stream tributary of the Killeen River, July 2024



Plate 4.3 Juvenile brown trout 0+ captured at site A2, July 2024



Plate 4.4 Representative image of site A2 on the unnamed tributary of the Killeen Stream

4.1.3 Site A3 – Unnamed Stream

Site A3 was situated on an unnamed small upland eroding spate stream tributary of the Killeen River downstream of site A2. The stream was 0.5-1m wide and between 0.1-0.15m deep with 2-2.5m high bank. The channel was historically modified (straightened) along the local road but retained a semi-natural profile with shallow riffle and glide sequences. The bed comprised of occasional small boulder, cobble and mixed gravels between rocky outcrops as with sites A2 and A3 upstream. The bed also had moderate siltation with evident infiltration and localised pockets of shallow silt. The stream supported no macrophytes due to shading by mature trees. The exposed boulder tops instream supported occasional *Pellia endiviifolia* with submerged boulders supporting occasional *Rhynchostegium riparioides*. No filamentous green algae was observed, due to the high shading. The stream was bordered by mature ash (*Fraxinus excelsior*), hazel and dense bramble (*Rubus fruticosus*) that overshadowed the stream.

The stream was considered a moderate quality nursery given broken riffle and glide with abundant rocky refugia for young of the year fish (0+) trout. Spawning quality was moderate given the presence of mixed gravels but was reduced given siltation and enrichment pressures. The presence of a low density ($n=9$) brown trout population supported the streams value as a nursery and spawning area. The stream was of too high energy to support lamprey and the species was not recorded present. While the stream had moderate quality for European eel (i.e. abundant rocky refugia and shading), the very shallow depth of the stream, small size and limited pool habitat may support the species absence. Furthermore, known downstream significant barriers in the Nore catchment also contributes to poor upstream passage for eel.

Biological water quality, based on Q-sampling, was calculated as **Q3-4 (moderate status)** (Appendix A). No macro-invertebrate species of conservation value greater than 'least concern,' according to national red lists, were recorded via Q-sampling.

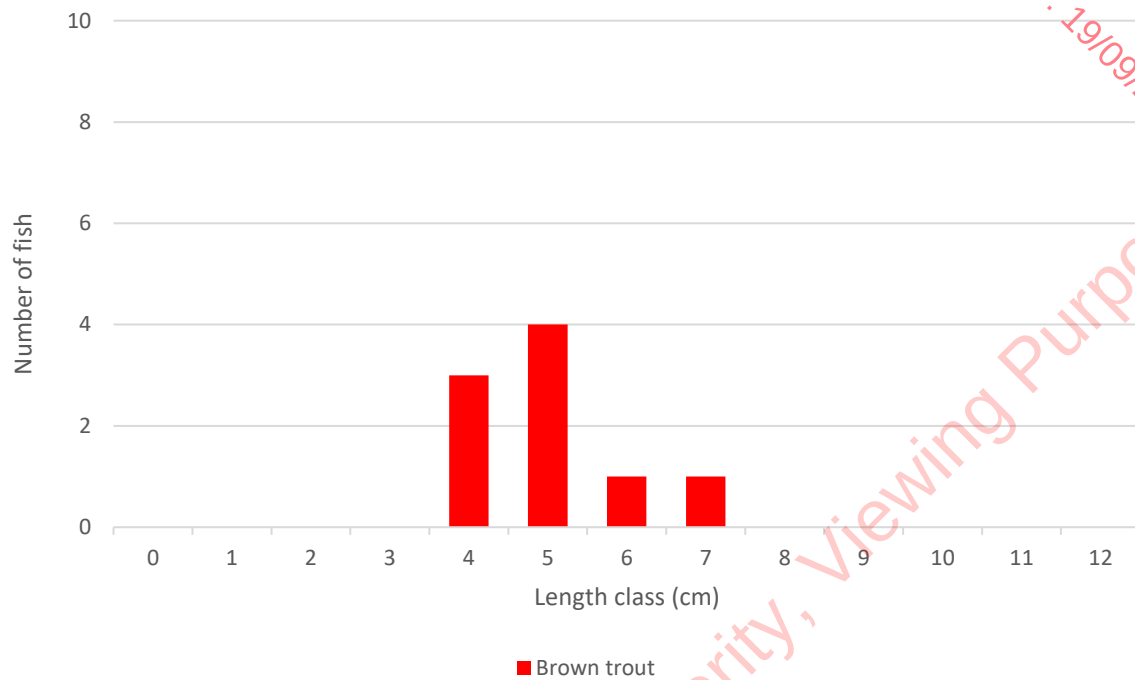


Figure 4.3 Length frequency distribution of brown trout recorded at site A3 on the unnamed stream tributary of the Killeen River, July 2024

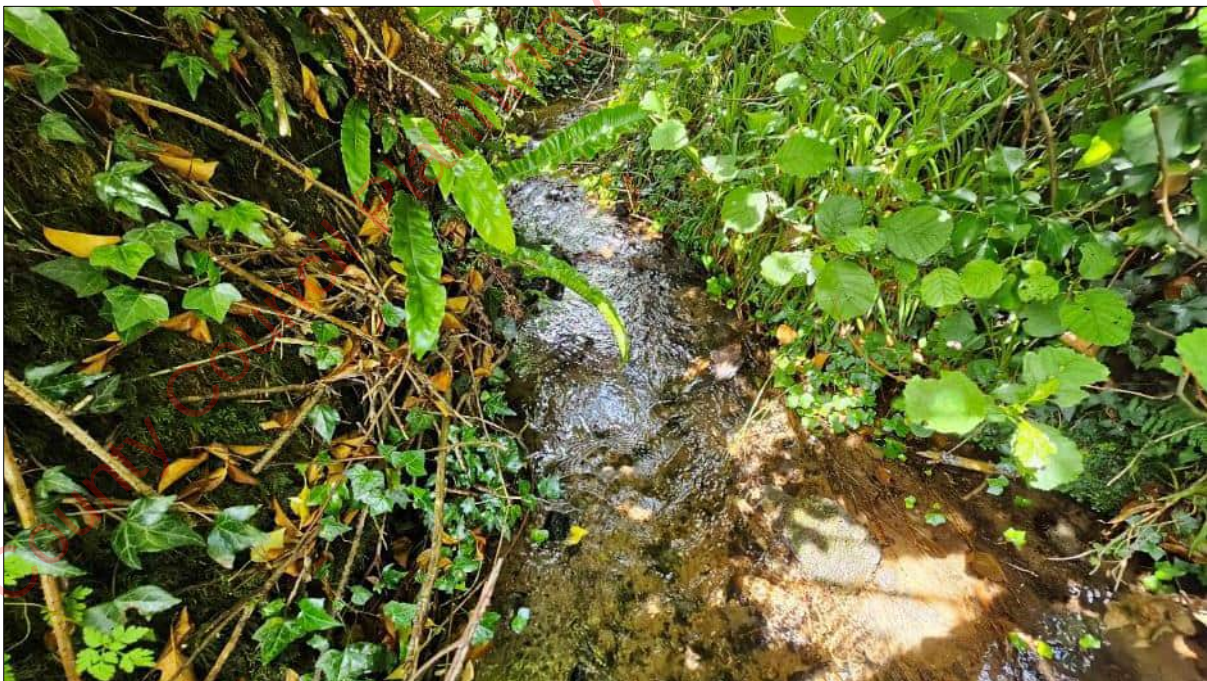


Plate 4.6 Representative image of site A3 on the unnamed stream tributary of the Killeen River, July 2024

4.1.4 Site B1 – Killeen River

Site B1 was situated on the Killeen River an upland eroding spate stream (FW1), 4-5m wide and between 0.1-0.3m deep with 1-2m high banks. The channel had semi-natural meandering profile that was dominated by riffle and glide sequences with occasional pool. The bed comprised of frequent small boulder and cobble with mixed gravels between coarser substrata. Beds of exposed small boulder and cobble were present in the margins. The bed also had light siltation and compaction. The river was of too high energy to support macrophytes. However, the instream boulders supported occasional *Rhynchostegium riparioides*. A low surface cover of green filamentous green algae was observed (c. 5%) indicating some low enrichment pressures. The river was bordered by scattered mature alder, grey willow and holly (*Ilex aquifolium*). The understories supported dense bramble, bracken (*Pteridium aquilinum*) and gorse (*Ulex europaeus*).

The river was considered a very good quality salmonid nursery given broken riffle and glide with abundant rocky refugia for juvenile fish that was reflected by the good density of 0+ and 1+ salmonids captured during electro-fishing ($n=20$ fish). Spawning quality was locally good given the presence of mixed gravels with pockets of deeper glide and pool. The river was of too high energy to support lamprey and the species was not recorded present. While the stream had moderate quality for European eel (i.e. abundant rocky refugia and shading), the limited pool habitat accounted for the species absence inclusive of known downstream barriers in the Nore catchment.

Biological water quality, based on Q-sampling, was calculated as **Q4 (good status) (Appendix A)**. No macro-invertebrate species of conservation value greater than 'least concern,' according to national red lists, were recorded via Q-sampling.

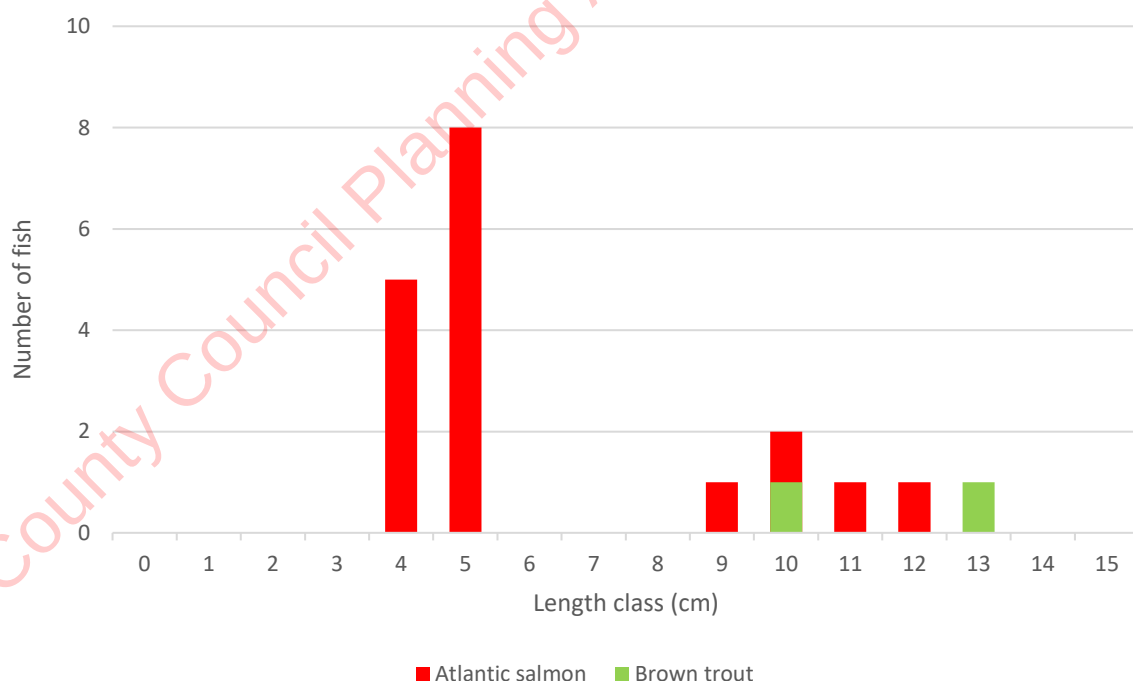


Figure 4.5 Length frequency distribution of brown trout recorded via electro-fishing at site B1 on the Killeen River, July 2024



Plate 4.8 Juvenile 1+ brown trout and salmon parr recorded at site B1 on the Killeen River, July 2024

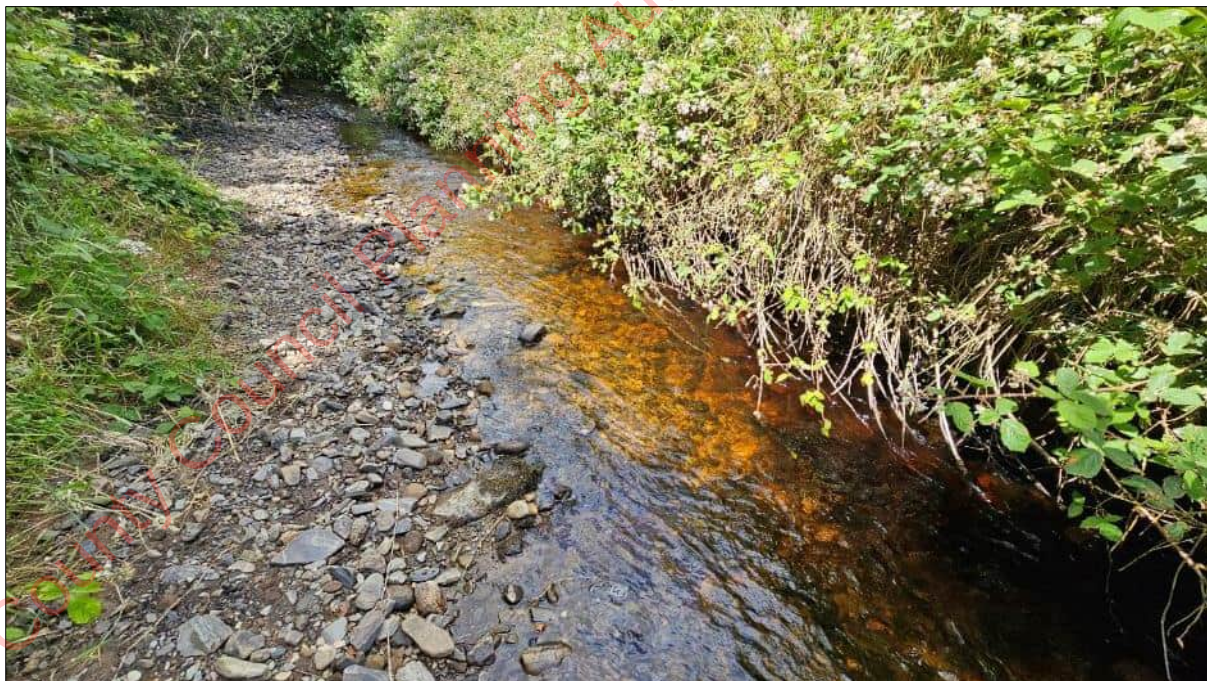


Plate 4.9 Representative image of site B1 on the Killeen River, July 2024

4.1.5 Site B2 – Killeen River

Site B2 was situated on the Killeen River, an upland eroding spate stream (FW1), 4-5m wide and between 0.1-0.3m deep with 1m bank heights. The channel had a semi-natural profile dominated by riffle and glide sequences with occasional pool. The bed comprised of frequent small boulder and cobble with mixed gravels between coarser substrata. The bed also had moderate siltation and compaction with evident silt plumes underfoot. The river was of too high energy to support macrophytes. However, the instream boulders supported abundant *Rhynchostegium riparioides* and occasional *Leptodictyum riparium*. A low surface cover of green filamentous green algae was observed (c. 5%) indicating some low enrichment pressures. The river was bordered by scattered mature ash with dense bramble, bracken and gorse in the understories. Tree canopy cover was significantly higher upstream with heavy shading.

The river was considered a very good quality salmonid nursery given broken riffle and glide with abundant rocky refugia for juvenile fish that was reflected by the good density of 0+ and 1+ salmonid captured during electro-fishing ($n=43$ fish). Spawning quality was locally good given the presence of mixed gravels but was reduced given more limited deep glide and pool. The stream was of too high energy to support lamprey and the species was not recorded present. While the stream had moderate quality for European eel (i.e. abundant rocky refugia and shading), the limited pool habitat reduced habitat suitability for the species. Furthermore, known downstream significant barriers in the Nore catchment also contributed to poor upstream passage for eel.

Biological water quality, based on Q-sampling, was calculated as **Q4 (good status) (Appendix A)**. No macro-invertebrate species of conservation value greater than 'least concern,' according to national red lists, were recorded via Q-sampling.

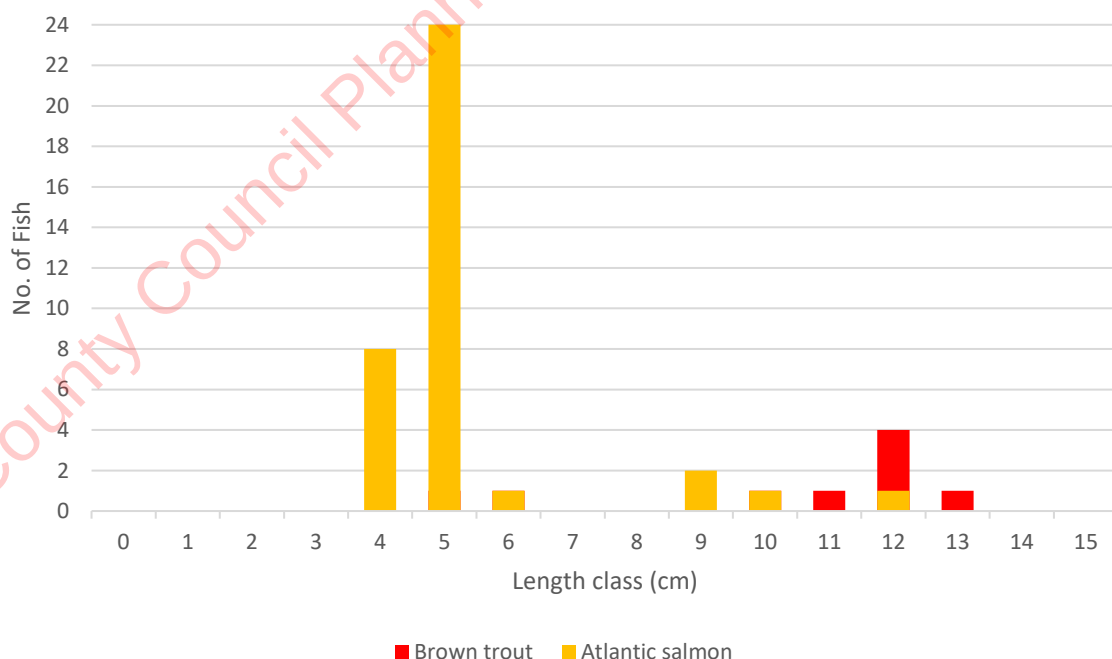


Figure 4.6 Length frequency distribution of fish recorded at site B2 on the Killeen River, July 2024



Plate 4.11 Representative image of site B2 on the Killeen River

4.1.6 Site B3 – Killeen River

Site B3 was situated on the Killeen River, an upland eroding spate stream, 4-5m wide and between 0.1-0.3m deep with 0.5-1m high banks. The channel had semi-natural meandering profile that was dominated by riffle and glide sequences with occasional pool. The bed comprised of frequent small boulder and cobble with mixed gravels between coarser substrata. The bed also had moderate siltation and compaction with evident silt plumes underfoot. The river was of too high energy to support macrophytes. However, the instream boulders supported occasional *Rhynchostegium riparioides* and *Chiloscyphos polanthos* with *Cinclidotus fontinaloides* recorded as rare. A low surface cover of green filamentous green algae was observed (c. 5%) indicating some low enrichment pressures. The river was bordered by scattered mature alder, grey willow and holly. The understories supported dense bramble, bracken and gorse.

The river was considered a very good quality salmonid nursery given broken riffle and glide with abundant rocky refugia for juvenile salmonid fish. This was reflected by the good density ($n=47$) salmonids captured during electro-fishing. Spawning quality was locally good given the presence of mixed gravels with pockets of deeper glide and pool. The river was of too high energy to support lamprey and the species was not recorded present. While the stream had moderate quality for European eel (i.e. abundant rocky refugia and shading), the limited pool habitat reduced habitat suitability for the species. Furthermore, known downstream significant barriers in the Nore catchment also contributed to poor upstream passage for eel.

Biological water quality, based on Q-sampling, was calculated as **Q4 (good status)** (Appendix A). No macro-invertebrate species of conservation value greater than 'least concern,' according to national red lists, were recorded via Q-sampling.

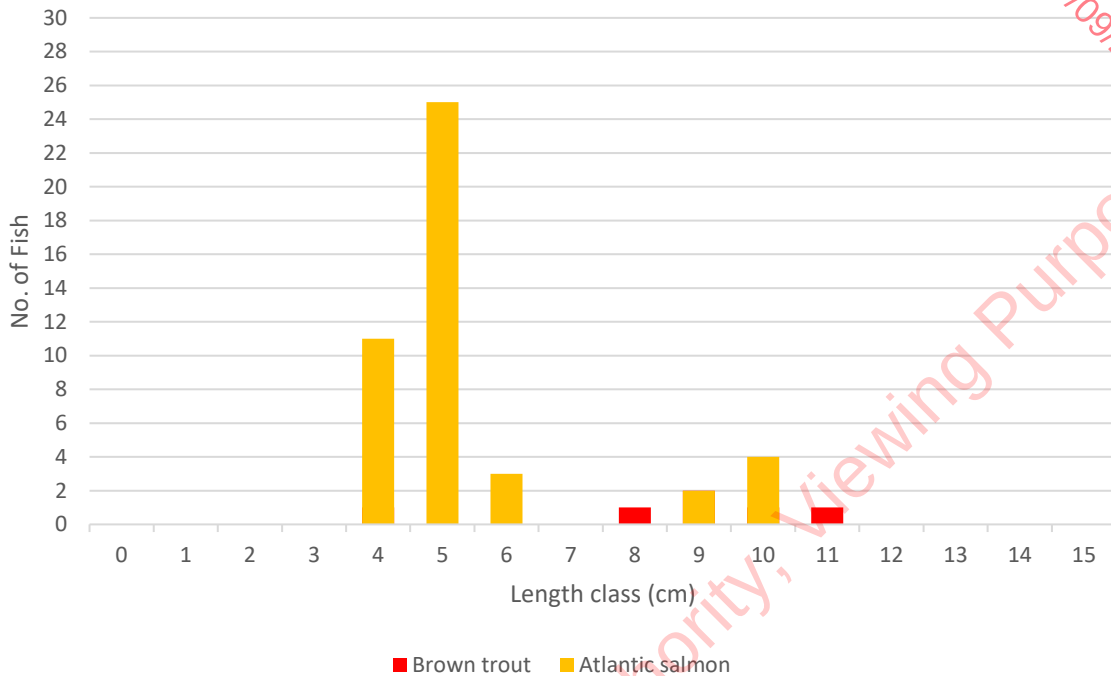


Figure 4.7 Length frequency distribution recorded via electro-fishing at site B3 on the Killeen River, July 2024



Plate 4.12 Juvenile 0+ and 1+ salmon captured at site B3 on the Killeen River, July 2024



Plate 4.13 Representative image of site B3 on the Killeen River, July 2024

4.2 Biological water quality (macro-invertebrates)

No rare or protected macro-invertebrate species (according to national red lists) were recorded in the biological water quality samples taken from a total of 6 no. riverine sites in July 2024 (**Appendix A**).

Sites A1, A2 and A3 on the unnamed stream tributary of the Killeen River achieved **Q3-4 (moderate status)** water quality. There were no EPA group A (pristine water indicator species) in the samples collected. The survey sites were dominated by EPA group B and C (lower quality water quality indicators) and thus did not meet the qualifying criteria for good status (Q4) biological water quality as set out by Toner et al. (2005).

All three sites on the Killeen River (sites B1, B2 and B3) however, did achieve **Q4 (good status)** water quality. This status was based on the presence of EPA group A (most pollution sensitive) mayfly and stonefly species (i.e. *Rhithrogena semicolorata*, *Ecdyonurus dispar* & *Isoperla grammica*) in combined numbers $\geq 5\%$ of the total sample abundance (**Appendix A**). All sites on the Killeen River therefore met the target good status ($\geq Q4$) requirements of the European Union Environmental Objectives (Surface Waters) (Amendment) Regulations 2019 and the Water Framework Directive (2000/60/EC) (**Appendix A**).

Table 4.1 Fish species densities per m² recorded at sites in the vicinity of the proposed development, July 2024 (**bold** indicates highest density recorded per species)

Site	Watercourse	CPUE (elapsed time)	Approx. area fished (m ²)	Atlantic salmon	Brown trout
A1	Unnamed Stream	5	100	0.000	0.060
A2	Unnamed Stream	5	100	0.000	0.110
A3	Unnamed Stream	5	100	0.000	0.090
B1	Killeen River	10	200	0.095	0.010
B2	Killeen River	10	200	0.185	0.045
B3	Killeen River	10	200	0.170	0.030

Table 4.2 Relative abundance of fish species of higher conservation value recorded via **electro-fishing** in the study area, July 2024

Site	Watercourse	Atlantic salmon	Brown trout	Other species
A1	Unnamed Stream	Not recorded	Low	Not recorded
A2	Unnamed Stream	Not recorded	Low	Not recorded
A3	Unnamed Stream	Not recorded	Low	Not recorded
B1	Killeen River	Moderate	Low	Not recorded
B2	Killeen River	High	Low	Not recorded
B3	Killeen River	High	Low	Not recorded

Table 4.3 Summary of aquatic species and habitats of higher conservation value recorded in the study area, July 2024

Site	Watercourse	Annex I aquatic habitats	Rare or protected macrophytes/aquatic bryophytes	Rare or protected macro-invertebrates	Other species/habitats of high conservation value
A1	Unnamed Stream	Not present	None recorded	None recorded	Brown trout
A2	Unnamed Stream	Not present	None recorded	None recorded	Brown trout
A3	Unnamed Stream	Not present	None recorded	None recorded	Brown trout
B1	Killeen River	Not present	None recorded	None recorded	Atlantic salmon & Brown trout
B2	Killeen River	Not present	None recorded	None recorded	Atlantic salmon & Brown trout
B3	Killeen River	Not present	None recorded	None recorded	Atlantic salmon & Brown trout

Conservation value: Atlantic salmon (*Salmo salar*) and lamprey (*Lampetra* spp.) are listed under Annex II and Annex V of the Directive on the Conservation of Natural Habitats of Wild Fauna and Flora (92/43/EEC) ('EU Habitats Directive'). European eel are 'critically endangered' according to most recent ICUN red list (Pike et al., 2020) and listed as 'critically engendered' in Ireland (King et al., 2011). Brown trout have no formal designation in southern Ireland but are a priority species in northern Ireland.

5. Discussion

5.1 Fisheries

Apart from Atlantic salmon parr and brown trout no fish or habitats of high conservation value were recorded during the current survey. Atlantic salmon are listed on Annex II and Annex V of the Habitats Directive (92/43/EEC). They are also a qualifying interest fish species of the hydrologically connected River Barrow and River Nore SAC (002162), situated 3km downstream of the study area (by water). Atlantic salmon were recorded at all sites on the Killeen River (i.e. sites B1, B2 & B3) but not on its unnamed stream tributary (i.e. sites B1, B2 and B3) (**Tables 4.2 & 4.3**). While not of significantly high conservation value, wild brown trout populations are of high local biodiversity value and were recorded at all sites in the study area at low densities.

All of the survey sites were of value as salmonid nurseries, although numbers of mixed-cohort trout were lower than anticipated for semi-natural spate type channels. The low trout densities may be as a result of enrichment and siltation pressures observed during the survey as trout recruitment is reliant on low order tributaries in the River Nore catchment (pers. obs.). The low density of trout in the Killeen River may reflect superior competition by salmon that in high energy higher order channels (where inter-specific competition exists) have better capacity to hold station in strong flows (i.e. sites A1, A2 & A3 on the Killeen River). Despite enrichment and siltation pressures the main channel of the Killeen River was achieving target 'good status' biological water quality (refer to biological water quality section 5.3 below).

Brook lamprey (*Lampetra planeri*) are listed as qualifying interests of the downstream-connecting River Barrow and River Nore SAC (002162) but were not recorded during the current survey. This was consequential of the high energy of the study area which discourages the settlement of deeper soft sediment deposits (most observed were superficial and or flocculent in nature). Lamprey species requires sufficient depth and particle composition for ammocoete settlement as per characteristics provided in Dawson et al., 2015; Aronsuu & Virkkala, 2014; Rooney et al., 2013; Lasne et al., 2010; Goodwin et al., 2008; Gardiner, 2003.

European eel are Red-listed in Ireland (King et al., 2011) and are classed as 'critically endangered' on a global scale (Pike et al., 2020). Habitat suitability was moderate and could support eel given the presence of flow refugia and food resources. However, downstream barriers in the Nore catchment (AMBER Consortium, 2020; Gargan et al., 2011) may restrict migration of eel into the upper reaches of the Killeen (Delour)_010 sub-basin.

5.2 Annex I aquatic habitats

The Annex I habitat 'Water courses of plain to montane levels, with submerged or floating vegetation of the *Ranunculion fluitantis* and *Callitriche-Batrachion* (low water level during summer) or aquatic mosses [3260]' (also referred to as floating river vegetation) (EC, 2013) is characteristic of lowland depositing spate river channels in Ireland with *Ranunculus-Callitriche* dominated habitat often occurring with *Oenanthe aquatica* in addition to a low diversity of aquatic mosses. However, the habitat was not recorded during the current survey, likely because of the high energy of the study area that precludes the settlement of representative macrophyte plants.

5.3 Biological water quality & pressures

In terms of biological water quality, all three sites on the Killeen River (sites B1, B2 & B3) met the target good status ($\geq Q4$) requirements of the European Union Environmental Objectives (Surface Waters) (Amendment) Regulations 2019 and the Water Framework Directive (2000/60/EC) (**Appendix A**). However, sites A1, A2 and A3 on the unnamed tributary of the Killeen River failed to achieve good status (i.e. moderate status **Q3-4**) biological water quality was recorded. Eutrophication (enrichment) and siltation pressures were particularly evident on the unnamed tributary of the Killeen River during the survey (sites A1, A2 & A3) that have contributed to biological water quality decline. Specifically this related to floc and silt settlement in addition to associated bed compaction (from silt infiltration). Likely sources included agriculture with evident cattle poaching observed during the survey. No rare or protected macro-invertebrate species (according to national red lists) were recorded in the samples taken from 8 no. riverine sites (**Appendix A**).

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7. Appendix A – Macro-invertebrates (biological water quality)

Table 9.1 Macro-invertebrate Q-sampling results, July 2024

Taxon	Family	Binomial name	A1	A2	A3	B1	B2	B3	EPA Groups
Ephemeroptera	Heptageniidae	<i>Rhithrogena semicolorata</i>	2	5	3	16	14	18	A
Ephemeroptera	Heptageniidae	<i>Ecdyonurus dispar</i>				3	2	4	A
Plecoptera	Perlodidae	<i>Isoperla grammatica</i>					1		A
Ephemeroptera	Baetidae	<i>Alainites muticus</i>	18	3			1		B
Plecoptera	Leuctridae	<i>Leuctra fusca</i>	3		1	10	7	13	B
Trichoptera	Glossosomatidae	<i>Glossosoma boltoni</i>				4	3	6	B
Trichoptera	Goeridae	Goeridae pupa		1					B
Trichoptera	Limnephilidae	<i>Halesus radiatus</i>				1			B
Trichoptera	Limnephilidae	<i>Potamophylax cingulatus</i>	1	1	1		1		B
Trichoptera	Limnephilidae	sp. indet.			1				B
Trichoptera	Odontoceridae	<i>Odontocerum albicorne</i>		5	3		2		B
Trichoptera	Sericostomatidae	<i>Sericostoma personatum</i>	2	2	1		1		B
Ephemeroptera	Baetidae	<i>Baetis rhodani</i>	10	5	4	13	8	13	C
Ephemeroptera	Ephemerellidae	<i>Serratella ignita</i>	7	7	4	12	45	14	C
Trichoptera	Hydropsychidae	<i>Hydropsyche siltalai</i>				1	1		C
Trichoptera	Philopotamidae	<i>Wormaldia occipitalis</i>	7		1				C
Trichoptera	Polycentropodidae	<i>Plectrocnemia conspersa</i>	2		1				C
Trichoptera	Rhyacophilidae	<i>Rhyacophila dorsalis</i>			1	5	3	4	C
Amphipoda	Gammaridae	<i>Gammarus duebeni</i>	15	6	7		15	9	C
Arachnida	Hydrachnidiae	sp. indet.					2	1	C
Coleoptera	Elmidae	<i>Elmis aenea</i> (adult)	2			1			C
Coleoptera	Elmidae	<i>Elmis aenea</i> (larva)					1	1	C
Coleoptera	Elmidae	<i>Limnius volckmari</i> (adult)					2	2	C
Coleoptera	Elmidae	<i>Limnius volckmari</i> (larva)			2	1	3		C
Coleoptera	Hydraenidae	<i>Hydraena gracilis</i>				1	3		C
Coleoptera	Scirtidae	Scirtidae larva	1						C
Diptera	Simuliidae	sp. indet.	10	2	16	4	5	5	C
Diptera	Chironomidae	Non-chironomus spp.	1	1	1	2	14	5	C
Diptera	Dixidae	sp. indet.	2	1	3				C
Diptera	Limoniidae	<i>Antocha</i> sp.			1				C

Taxon	Family	Binomial name	A1	A2	A3	B1	B2	B3	EPA Groups
Diptera	Limoniidae/Pediciidae	sp. indet.		1					C
Diptera	Pediciidae	Dicranota sp.	4	5			4	2	C
Hirudinidae	Glossiphoniidae	sp. indet.			1	1			D
Diptera	Chironomidae	Chironomus spp.					1		E
Annelidae	Oligochaeta	sp. indet.	2	6	4				N/A
Total Abundance			89	51	56	75	139	97	
Taxon Richness			17	15	19	15	23	14	
Q Rating			Q3-4	Q3-4	Q3-4	Q4	Q4	Q4	
Water Quality Status			Mod.	Mod.	Mod.	Good	Good	Good	

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