Summary of Ecological Survey of the Carrowniskey River and the Bellakip Stream

Summary of Report Commissioned by CALL – Climate Action Louisburgh Locality

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Background to this Study

Climate Action Louisburg Locality (CALL), in association the Local Authority Waters Programme (LAWPRO), commissioned this ecological baseline study of the Carrowniskey River and the Bellakip stream, to assess the macroinvertebrate community, algal and macrophyte communities, habitats, and supporting conditions. The aim of the study was to identify locations throughout each waterbody that are at risk of impact from adjacent land use/ activities and recommend measures to mitigate impacts and to restore, protect, or enhance the invertebrate and fish communities and their associated habitats and supporting conditions.

Ecological assessments of the Carrowniskey and greater Bellakip/Bunowen river systems conducted by the Environmental Protection Agency (EPA) indicate that, although the upper reaches of both systems have generally enjoyed high ecological status, ecological conditions decline before discharging into the Atlantic. The lower reaches of both systems are currently categorised as 'unsatisfactory' and at risk of failing to achieve Water Framework Directive (WFD) objectives.

This ecological and baseline study included two distinct components that form the basis of the current summary report. An initial desktop study was initiated in May 2023 in order to compile existing information relevant to the two catchments and to inform the degree to which field-based assessments were necessary, including the scope of such works. Field based surveys and site visits were conducted between June and August 2023.

In addition to the field-based surveys detailed in this summary report, volunteers from CALL performed extensive bankside investigations of riparian conditions along three sections of the two river systems.

Throughout this study the authors liaised closely with the *LIFE on Machair* (https://www.lifeonmachair.ie) project. This cooperation involved sharing of resources, knowledge, and advice on issues relating to freshwater ecosystems. Through this approach the *Life on Machair* (LOM) Roonah Restoration Project was linked with the current study, to maximise broader ecological benefits while minimising the risk of duplicating effort. There is significant potential for the mobilisation of funding and resources to support restorative initiatives or additional research on the Carrowniskey catchment, based on collaborative actions between the *LIFE on Machair* project and any additional projects arising from the current study.

Key Findings

Generally, both systems were found to be in good ecological condition. However, a pattern of declining water quality and ecological conditions was identified as sampling sites were assessed, moving downstream from the headwaters to the lower reaches of each river. Specific issues identified are listed below:

- Signs of significant point source pollution and associated reductions in ecological condition were identified at survey sites on both rivers. However, only a small number of sites showed signs of severe pollution.
- There is a general risk of diffuse pollution leading to enrichment of the water courses as well as risks from the use of herbicides/pesticides (e.g., MCPA).
- Peat extraction and livestock impacts were identified at a number of sites.
- The waste water treatment plant (WWTP) in Louisburgh has exceeded the plant's nominal design organic capacity during peak weeks in recent years (2017-2022).
- Numerous Emission Limit Value breaches have been recorded at the Louisburgh WWTP and significantly increased nutrient levels (ammonia and orthophosphate) have been recorded below the WWTP discharge points.
- Low flows and high water temperatures are undoubtedly an issue in these catchments, particularly in Roonagh Lough where low oxygen concentrations were also recorded. These issues are likely to increase as climate change is predicted to increase the intensity of summer droughts and heatwaves in the West of Ireland.
- Water abstraction for domestic and agricultural use may well pose a serious threat to fish passage and in-stream biota during prolonged periods of low flow. Potential increases in abstraction from the Bunowen for the Louisburgh Public Water Supply are of particular concern.
- Adequate shading is absent from significant sections of the Carrowniskey catchment, particularly where large swathes of marginal vegetation were recently removed from the river bank.
- A bridge apron attached to one of the Bunleemshough bridges may have the potential to impede the upstream movement of migratory fish, particularly in low water conditions.

Key Recommendations

Building Awareness

Fundamental to tackling the specific issues and risks highlighted in this report is building an awareness within the community of the finite and delicate nature of the freshwater resources within the two catchments surveyed during the present study.

While it is useful to list individual initiatives and tasks that might be undertaken by CALL or allied groups, it is essential that an understanding is fostered of the interactive nature of the complex issues that are currently affecting our rivers and streams across Ireland. At its most basic, in terms of protecting the overall biota within the streams, and the integrity of the water courses, it is vitally important to understand that the natural history of these creatures and plants is fundamentally dependent on the availability of an abundance of cold, clean water. The availability of a well-designed and managed water resources planning structure within the two catchments would guarantee for the future a means to manage and optimise the availability of water resources for the competing demands on water across the local area.

The challenges we face from climate change in particular will make this task increasingly difficult, as the extreme nature of the changes that will take place are unknown and likely to be unprecedented in nature. All stakeholders within the catchments must work closely together if we are to be successful in reducing or mitigating the current pressures and ensuring the availability of adequate water resources for the future.

The recommendations listed below should be reviewed in this context. An integrated and well-planned approach will lead to significant improvements in terms of consistent water volume, water quality and water conservation in the areas under study. The author's trust that the report's overall assessment of the needs and pressures on the Carrowniskey River will provide a comprehensive overview of the suite of pressures on water resources within the catchment and the potential solutions which could be adopted. The survey work on the Bellakip stream has highlighted individual issues on this small watercourse but our overall conclusion is that in order to deal holistically with issues relating to the totality of the Bunowen catchment, a more extensive baseline survey is required.

We are also of the view that, with the assistance of state agencies, the recommendations arising from this study should be progressed as quickly as possible. In order to assess the ongoing improvements in water quality at a local level and to ensure that all parties feel a sense of ownership in the success of such an integrated programme, it is important that structured training is made available to the relevant interest groups within the area. This will ensure a successful outcome from the recommendations below:

- **Remedial action, by the appropriate bodies, is strongly recommended to deal with the serious pollution issues identified on tributaries of the Carrowniskey and of the Bellakip.** These issues relate primarily to peat extraction and agriculture and are described in detail in the Technical Report.
- **Building awareness within the local community of the finite and delicate nature of the freshwater resource within the two catchments will encourage positive land management practices.** All stakeholders within the catchments must work closely together to successfully reduce or mitigate the current pressures and ensure the availability of adequate water resources for the future.
- **Training and up-skilling of volunteers from the local community to act as Citizen Scientists to assess and monitor water quality in the local streams and rivers.** Volunteers could also take direct action to remove the intensive weed growth noted in some of the streams (i.e., *Oenanthe Aquatica*, the fine-leaved water-dropwort) and deal with any invasive plants that appear over time in the two catchments.
- **Reduce or eliminate livestock access to the streams and provide alternative freshwater drinking sources in order to minimise nutrient and pathogen loads while reducing erosion and sedimentation.** The evidence for the benefits of excluding cattle from watercourses is particularly strong in relation to hydromorphology (i.e., the physical structure and form of the stream bed and river bank contours), sedimentation, and bacterial parameters (Ó hUallacháin, 2019; O'Callaghan et al., 2018).
- **Manage riparian / marginal vegetation so as to promote ecological productivity while protecting against harmful impacts of climate change.** In the context of climate change impacts, it is important that bankside vegetation is managed so that it provides the required level of shading. However, where vegetation has formed dense stands of trees and bushes blocking out all light from the stream bed (so called tunnelling), selective removal of sections of the river bank vegetation is recommended.

- **Establish measures to reduce erosion and sedimentation of the stream bed.** Care should be taken to ensure that the integrity of the natural river banks is secured by means of fencing and encouraging a strong growth of natural vegetation. Where bank erosion is present and where the river channel is shallow and broadening out, there are a number of low cost, well-tested nature based techniques that can be used.
- **Improvements that bring domestic septic tank systems in line with current regulations will ensure that nutrient loss to surface waters and associated eutrophication and human health risks are minimised.**
- **Improvement to level of service of the Louisburgh WWTP is required to ensure that discharges are kept in line with designated emission limit values and that downstream habitats and nearby bathing areas are protected from the harmful effects of effluent discharge.**
- **Establish voluntary sanctuary areas in conjunction with local landowners to ensure the retention of these habitats.** In addition, the "Waters of LIFE" integrated project (https://www.watersoflife.ie/) supports the work of the Blue Dot Catchments Programme by providing results-based agricultural payments schemes that link payments to the environmental quality of a farm, with higher environmental quality resulting in a higher payment level to farmers.
- **Conduct electro fishing surveys (particularly in the Bunowen) to assess the abundance of juvenile salmon and trout as well as other species of conservation interest such as lamprey and European eel.**
- **Assess the potential of a bridge apron on the Bunleemshough tributary of the Carrowniskey system to impede fish migration and undertake mitigation actions as required**. It is recommended that CALL liaise with the East Wicklow River Trust (https://wicklowrivers.ie/) to gauge the feasibility of assessing and mitigating the potential effects of the bridge apron barrier.
- **Encourage angling on the Carrowniskey River and perhaps the re-establishment of a local angling club.** There are great advantages to having anglers actively fishing a water, as their presence can encourage young people locally to take up the sport and take an interest in the conservation of the local waterways and their catchments. An angling club can encourage additional visitors to the area. Anglers can provide valuable information on the status of adult fish stocks present and the over quality of the river habitat / water quality.

Water Chemistry and Waste Water

EPA water chemistry data for the Bunowen (2007 to present) indicate that phosphate and ammonia/nitrate concentrations on sampling dates have generally been within the 'Good' Environmental Quality Status (EQS) thresholds. However, elevated levels of phosphate and ammonia have been detected upstream of the Louisburgh wastewater treatment plant (but downstream of the EPA Louisburgh Bridge site) which, combined with low EPA Q values and the presence of filamentous algae at the site, suggests that there is a nutrient pressure occurring upstream of the WWTP. The Louisburgh WWTP itself is also likely to be impacting the water quality downstream of its effluent discharge point. For example, the WWTP exceeded EVLs for ammonia effluent discharge in 2019 and 2017, with a striking increase in mean orthophosphate concentrations recorded from the sampling site above the WWTP discharge point (0.0106 mg/L) to the sampling site below the discharge point (0.0875 mg/L) in 2017.

The only publicly available chemistry data for the Carrowniskey relate to a site in the upper catchment, far upstream of sites that have yielded low EPA Q values in the past. Concentrations of ammonia, phosphates and nitrates have been below detection thresholds in virtually all samples and well below EQS thresholds.

Physio-chemical conditions in the Roonagh Lough were assessed on in June 2023. Conductivity was well within the normal range of conductivities for Irish freshwaters, while vegetation around the lake margins is typical of boggy wet meadow or marshy conditions rather than salt marshes. Oxygen levels at one of the sites were worryingly low, particularly given anecdotal accounts of the lagoon's importance in the life cycle of local salmonids.

Field Surveys

The field survey of the Carrowniskey and Bellakip rivers, that was conducted for the purpose of this report, combined a modified version of the Atlantic Salmon Trust (AST) Small Stream Characterisation System (SSCS) with observational site visits and citizen science riverbank surveys. As with the EPA's biological river quality surveys, the SSCS uses the relative proportions of pollution sensitive and pollution tolerant macroinvertebrates resident at a river site to calculate an ecological score that represents the ecological status of the site. At each SSCS survey site, a 3-minute kick sample was conducted followed by an identification and enumeration of all macroinvertebrates captured. River characteristics were also recorded for each site including river substrate composition, water clarity, river depth and width, flow rate, aquatic vegetation types present, bank conditions, signs of erosion or modification, presence of barriers, sources or signs of pollution, riparian habitat, surrounding land

use, animal access and/or fencing, width and state of buffer zones, degree of shading, and any other pertinent factors observed. Field surveys indicated that both rivers are generally in good ecological condition with very good conditions found in the upper reaches. However, a pattern of declining water quality was identified as sampling sites were assessed, moving downstream from the headwaters to the lower reaches of each stream. These results are in keeping with EPA biological (Q value) surveys from sites in both catchments that depict a broadly similar pattern of High, Satisfactory status sites in the upper catchments declining to Moderate, Unsatisfactory status sites as the rivers approach the sea. Field survey results from the current study for each site are discussed in detail in the Technical Report.

Fish Populations

During the course of our field surveys, we recorded the presence of Atlantic salmon, brown trout and European eel in the Carrowniskey River, and we recorded the presence of Atlantic salmon, brown trout, and three spined stickleback in the Bellakip river. Both rivers generally retain their natural sinuosity with riffle, pool, glide sequences and a profusion of good habitat for juvenile salmonids as well as some deep holding habitat for adult salmon and sea trout. SSCS sampling revealed an abundant supply of invertebrates, the staple food source for juvenile salmonids and most adult brown trout. Suitable gravel for salmonid spawning was observed throughout both rivers but was particularly prevalent in the upper reaches.

During a warm, low water period in June 2023 Limnos Consultancy recorded water temperatures of 18.8 °C and dissolved oxygen saturation levels of only 65.6% in Roonagh Lough (the only site visit during which these parameters were recorded). Given that salmonid performance suffers below 80% oxygen saturation and mortality starts to occur at around 40%, the conditions recorded in Roonagh are a cause for concern. As exceptionally high summer temperatures become more common and as climate change impacts are predicted to cause a substantial increase in in the occurrence of summer droughts in Ireland, limiting nutrient input into river systems such as the Carrowniskey and the Bellakip may be a crucial step in protecting native salmonid populations.

Uisce Eireann Louisburgh Public Water Supply

The Bunowen River is the water source for the Louisburgh Public Water Supply (PWS) that, as of 2022, services a population of 808. Mean daily hydrological yield from the river is 4989 m^3 and mean daily water abstraction in Louisburgh is 340 m^3 (i.e., 6.8% of hydrological yield). It should be noted that during low flow periods, daily water abstraction will represent a significantly higher proportion of the hydrological yield. However, Uisce Éireann lists a theoretical future abstraction rate of 1843 m^3/day

which would represent 37% of mean hydrological yield and potentially have significant impacts on the downstream habitat during low flow periods. Uisce Éireann has reported breaches for excess levels of the herbicide MCPA in the Louisburgh public drinking water supply in 2015, 2017, 2018, 2020, 2021, and 2022, indicating agricultural pressures upstream.

Riparian Conditions

Data from satellite imagery, site visits, and citizen science riverbank surveys indicate that a combination of fenced and unfenced buffer strips encompassing mature trees, shrubs and ground cover plants run along the majority of the main branch of the Bellakip River and many sections of the Carrowniskey system. Riparian tree cover is less prevalent in the headwaters of the two systems; however, this is unsurprising given the upland nature of the surrounding terrain. While riparian vegetation is plentiful in some sections of the middle/lower Carrowniskey system, there are also several areas where riparian trees are almost entirely absent with evidence of recent and historical tree removal. Riparian vegetation provides a host of benefits to river ecosystems and adjacent lands by slowing water movement, stabilising riverbanks, and cooling waters through shading. The latter is of particular importance as rising freshwater temperatures begin to impact sensitive cold-water species such as salmon and trout.

In contrast, river tunnelling, the total or near-total over-shading of a stream or river by trees or vegetation, was noted along substantial sections of the Bellakip. Tunnelling can significantly limit macrophyte and periphyton growth as well as overall ecological productivity in the river habitat. However, given the lack of riparian tree cover in nearby sections of the Carrowniskey, the reduction in water temperature provided by this tunnelling may offset any localised loss in productivity.

Although well maintained fences exclude livestock from a large proportion of the riverbed and riparian habitat in both river systems, livestock have direct river access in many sections. Fencing off the unfenced sections of river and providing drinking sources away from the riverbanks would provide a number of benefits. By excluding livestock from riparian habitat, riverbanks would be protected from poaching and erosion, allowing a natural channel morphology to develop and persist. In addition, preventing livestock from entering the river itself would protect in-stream habitats (e.g., salmonid spawning gravels) from mechanical disturbance while reducing direct organic (faecal) inputs into the freshwater environment, with positive implications for environmental and human health.

Connectivity and Barriers

River connectivity is critical for the conservation of freshwater ecosystems because barriers alter not only biological communities, but also abiotic conditions within the ecosystem itself. Site visits made

during the course of this project indicate that connectivity in the Bellakip and Carrowniskey catchments is generally well maintained. A series of waterfalls observed in the Carrowniskey headwaters are likely to prevent all upstream movement of salmonids or eels to the uppermost headwaters of the system (Fig. 34). However, these barriers are entirely natural and, given the paucity of invertebrates observed further upstream, are likely to have a negligible impact on salmonid productivity in the overall catchment.

A single artificial potential barrier was identified on the Bunleemshough branch of the Carrowniskey River, where the R378 road bridge crosses the river (53°42'46.31"N, 9°52'48.20"W) (Fig. 35). At this location the foundations / apron of the bridge form 2 steps that may present a challenge to fish moving upstream. During low flows, the water between the steps (i.e., on top of the first step) is shallow, and it is unlikely that a salmonid could hold there or gain momentum to jump the second step. It would be worth assessing this potential barrier in the future and consider remedial actions if necessary.

Concluding Remarks

This document represents a summary of the key findings and recommendations from an ecological baseline study of the Carrowniskey River and the Bellakip stream. Full details of this study can be found in Finlay, R., and Whelan, K.F. (2023), *Survey of the Carrowniskey River and the Bellakip Stream, a tributary of the Bunowen River, County Mayo*, Technical Report Commissioned by CALL – Climate Action Louisburgh Locality.