TRANSBOUNDARY SUBMISSION

ANNEX TO sHRA

Alba Ecology Ltd.

Dr [redacted], FCIEEM

November 2025

1. INTRODUCTION

1.1 Qualifications and Relevant Experience

- My name is Dr [redacted], and I am an ecological consultant and ecologist. I have a Bachelor of Science Honours degree in Environmental Studies from Hatfield Polytechnic (University of Hertfordshire), England and a doctorate in Zoology from the University of Aberdeen, Scotland. I am a Fellow of the Chartered Institute of Ecology and Environmental Management (FCIEEM). In 2023, the Scottish Government appointed me as a Member of the Board of the Cairngorms National Park Authority. I am Managing Director of a Scottish-based ecological consultancy called Alba Ecology Ltd, at Grantown on Spey, Moray, Scotland.

- I have thirty years' experience in wildlife research, land-use management, conservation planning and policy development and ecological assessments in the UK and Ireland, during which I have produced over 300 commissioned reports, peer-reviewed scientific papers and book chapters. In 2014 I was awarded the Royal Society for the Protection of Birds' '*Species Champion Award*' at the Nature of Scotland Awards for my on-going work on the endangered freshwater pearl mussel *Margaritifera margaritifera* (hereafter referred to as 'pearl mussel').

- I am recognised as a UK authority on the survey methods, ecology and conservation of the pearl mussel. In this regard, I have completed many hundreds of pearl mussel surveys, impact assessments, mitigation strategies and have helped develop and deliver many species and habitat management action plans for pearl mussels. As part of my pearl mussel work I have published sixteen peer-reviewed scientific papers and two book chapters on the species (Appendix 1), including standardised shallow-water[1] and deep-water survey methodologies[2] for the species. I have

[1] [redacted]

undertaken both the first[3] and the second[4] Scottish national pearl mussel surveys. I have also undertaken Site Condition Monitoring for all of Scotland's designated sites for pearl mussels and continue to advise Scottish Government on conservation matters pertaining to pearl mussels, including the potential designation of a new suite of Special Areas of Conservation (SAC) for pearl mussel in 2025-2026.

1.2 Involvement in this Proposal

- I have provided ecological advice in relation to pearl mussels to Dalradian Gold Ltd. since 2020 to inform ecological assessments.

1.3 Transboundary submission

- Transboundary submissions have raised specific issues regarding pearl mussels. By way of example:
- Environmental Justice Network Ireland has stated that the pearl mussel, a critically endangered species, is dependent on the Atlantic salmon, so the effects are cumulative and interconnected. The Owenkillew River, the Owenreagh River and the River Foyle and Tributaries SAC are not only hydrologically linked but ecologically integrated with smaller tributaries within the catchment of the SAC which are also very important ecological resources for Atlantic salmon in particular. All three designated rivers are currently assessed to be in unfavourable condition.
- [redacted] - Pearl mussels, an endangered species, present in Owenkillew River, are acutely sensitive to sedimentation. According to the IUCN Red List, increased sediment load can suffocate juvenile mussels and impair water filtration capacity.

[2] [redacted]

[3] [redacted]

[4] [redacted]

- Donegal County Council raise the issue screening and discharge consents (13.1 page 23 of 27) and provides a substantial Loughs Agency submission dated 23rd April 2025. That contained a discussion of potential for pearl mussel in the CurraghinanIt Burn (eDNA Investigation) page 116/160 – "*No positive replicates were recorded for pearl mussel, however, according to SureScreen Scientifics, the optimal time to sample for freshwater pearl mussel eDNA is between June and August whereas this survey took place in December*".
- This Annex will:
    - Consider concerns raised in relation to pearl mussels in the Transboundary process.
    - Provide my conclusions as regards any likely significant effects on pearl mussels.
    - Consider the sufficiency of mitigation and enhancement plans as they pertain to pearl mussels.
- This Annex focuses on the biological requirements of pearl mussel and refers to technical documents where it is considered necessary. I am not a trained hydrologist, but I have practical working knowledge of the aquatic processes that take place within pearl mussel watercourses and catchments.
- Where appropriate, additional reference information is provided in footnotes. For ease of reading, technical terms are only used where strictly necessary, with plain English preferred whenever possible.

2.4 Pearl mussel water quality requirements

- As water quality is very important to pearl mussels, it has been the focus on lots of conservation research. According to the British Standard[5], ten water quality features are particularly important for pearl mussels:
    - Phosphorus;

[5] BSI Water quality – Guidance standard on monitoring freshwater pearl mussel (*Margaritifera margaritifera*) populations and their environment BS EN 16859: 2017.

- Nitrogen, including ammonia;
- BOD5/dissolved oxygen;
- pH;
- Calcium;
- Alkalinity;
- Electrical conductivity;
- Temperature;
- Toxic contaminants; and
- Turbidity, i.e. suspended solids.

4.2 Water quality

- I have had regard to the Hydrological Assessment Tables presented at Annex 13 of the sHRA (2025). It is important to consider these discharges specifically in relation to pearl mussel water quality standards as articulated by the Conservation Objectives and the relevant JNCC target thresholds, recognising that JNCC targets are not absolute limits, rather observed values.

Summary

- The proposed discharge levels are unlikely to significantly adversely affect pearl mussels or their instream habitats.
- It is beyond my competence as a pearl mussel ecologist to review the technical water quality modelling and discharge predictions. Therefore, my evidence relies on the accuracy of this modelling.

4.4 Betterment Plan

- In response to widespread concerns regarding the proposed mine discharges and discharge consents required and in accordance with best practice guidance, an environmental Betterment Plan[6] was produced by the Applicant in 2024 (TR6 App 13 Betterment Plan), which built upon relevant elements of other plans.
- The focus of the Betterment Plan is on delivering improvements to water quality within the Owenkillew SAC and delivering improvements to wetland, riparian and aquatic environments in order to further the conservation aims for the designated site and its qualifying species e.g. pearl mussel.
- The following three broad objectives, each of which will help improve the existing conditions for pearl mussel, have been identified as part of the Betterment Plan:
    - Objective 1: Reduce nutrient loading in the Owenkillew SAC.
    - Objective 2: Manage and monitor newly created and enhanced habitats to ensure positive long-term outcomes.
    - Objective 3: Facilitate projects providing additional betterment at offsite locations which will have specific and direct benefits to qualifying interest features of the nearby Owenkillew SAC and Owenreagh ASSI.
- According to the Betterment Plan, Objective 1 is being achieved through the cessation of farming practices on its land (c. 240ha). As part of the proposal, the

[6] Different jurisdictions use different titles for what are ostensibly the same type of documents e.g. Biodiversity Enhancement and Mitigation Plans, Species and Habitat Management Plans, and Environmental Mitigation Plans. The content of such plans does vary, often according to whether *Likely Significant Effects* have been

Applicant commits to the removal of livestock farming across its entire landholding and there will be no further addition of fertiliser (of any kind) to its landholding. The Betterment Plan states that this would reduce the N load into the Owenkillew SAC. This likely would have an overall positive impact on pearl mussels.

- Objective 2 focuses on habitat management on land within the Applicant's direct control, including on aspects that are likely to have both direct and indirect positive impact on pearl mussels such as blocking drains in blanket bog, thus reducing suspended solids (e.g. peat sediment) in the relevant watercourses. There will also be creation of riparian buffers along watercourses, creation of wetlands; fencing off of watercourses within/adjacent to grazing land; and the removal of invasive non-native species. This will result in at least 2km of watercourse corridor enhancement being delivered, which will undoubtedly benefit pearl mussels.
- Tree planting is planned along the watercourse including the Owenkillew River and the Glenlark Burn and will aim to increase areas of shade and help stabilise riparian bank habitats present. This will undoubtedly benefit pearl mussels. Riparian trees have the ability to influence water temperature by providing shade and there is increasing evidence and recognition that this can substantially moderate peak summer temperatures, preventing damage to pearl mussels and their host fish[7][8]. Riparian tree roots also help to stabilise instream substrate habitats, likely to be of key importance to pearl mussels as climate change makes NI riverbed habitats more unstable.
- The potentially beneficial effects of targeted catchment management actions for downstream aquatic species e.g. pearl mussels and salmonids, such as those

predicted and therefore if mitigation to offset or compensate for these is required or not.

[7] Scottish Native Woods. (no date) Restoring and Managing Riparian Woodlands.

[8] Cosgrove, P., Shields, D., Anderson, D., Massey, K., Cosgrove, C. & Sime, I. 2022. The Impact of a drought on key freshwater pearl mussel *Margaritifera margaritifera* populations in Scotland. J. of Conchology 44: 1-15.

outlined in the Betterment Plan, should be more widely recognised as contributing directly to ecosystem resilience at the catchment scale for the SAC[9][10].

- The list below, provided in the Betterment Plan represents the actions which the Applicant will deliver.
    - Removal of farm related N and P inputs on land under its control, more than off-setting the projected discharges which will arise in view of the proposed discharge consents;
    - Peatland restoration initiatives;
    - Silt-traps within drainage;
    - Improved riparian planting (native, permanent tree planting);
    - Pocket wetland creation;
    - Stock fencing maintenance to ensure stock remains excluded from Applicant land;
    - Invasive species monitoring and management;
    - Water quality monitoring;
    - Pearl mussel monitoring;
    - Removal of litter/debris from watercourses; and
    - Local community tree nursery and tree planting initiatives.
- From a technical EcIA perspective, effective delivery of the actions outlined within the Betterment Plan are considered likely to exceed (and so more than offset) nutrient discharges associated with the mine and help improve overall water quality in the Owenkillew and Owenreagh Rivers, thereby benefitting pearl mussel.
- The Betterment Plan could be dramatically increased in terms of scale and ambition but would need the support of the regulators and other partners. Dalradian Gold Ltd.

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[9] Moorkens, E. 2009. A Catchment Management approach to the conservation & restoration of *Margaritifera margaritifera* populations in the Republic of Ireland. In: Proceedings of the International Conference in Sundsvall, Sweden, 2009. Aquatic Conservation with Focus on *Margaritifera margaritifera*. (ed.): Henrikson, L., Arvidsson B. and Osterling, M. pp. 118-130.

[10] Degerman, E., Alexanderson, S., Bergengren, J., Henrikson, L., Johansson, B-E., Larsen, B.M. & Söderberg,

is one of the few organisations that could afford to fund the large-scale works needed, especially in relation to tackling detrimental agricultural nutrient inputs across the Owenkillew SAC and Owenreagh ASSI catchments.

4.6 Conservation Objectives

- CIEEM guidance states "*Significance is a concept related to the weight that should be attached to effects when decisions are made. For the purpose of EcIA, 'significant effect' is an effect that either supports or undermines biodiversity conservation objectives for 'important ecological features' or for biodiversity in general. Conservation objectives may be specific (e.g. for a designated site) or broad (e.g. national/local nature conservation policy) or more wide-ranging (enhancement of biodiversity)".*
- Therefore, when assessing potential impacts on designated sites it is important to consider whether the Proposed Development, or the associated activities, are likely to undermine the conservation objectives of the designated site, including the conservation status of the qualifying species or habitats for which the site is designated (CIEEM, ibid).
- Having considered the likely magnitude of impacts and effects of the Proposed Development on the qualifying species of the Owenkillew SAC and based on evidence presented, it can be concluded that there would be no likely significant effects on the pearl mussel qualifying feature and so the Proposed Development is not predicted to give rise to adverse effects on the integrity of the Owenkillew SAC based on the site's conservation objectives (Table 1).

H. (2009) Restoration of freshwater pearl mussel streams. WWF Sweden, Solna.

Table 1. Summary of Potential Impacts on the Owenkillew SAC pearl mussel Conservation Objectives

SAC Conservation Objective[11]	Predicted Adverse Impact
To maintain (or restore where appropriate) the 'Fresh Water Pearl Mussel' to favourable status	
Maintain and if feasible enhance population numbers through natural recruitment	**None**, no change to the pearl mussel population as a viable component of the SAC. The Proposed Development will improve water quality a key pre-requisite for successful recruitment through implementation of a Betterment Plan.
Improve age structure of population	**None**, the existing age structure of pearl mussel within SAC would remain unchanged, i.e. dominated by adults. The Proposed Development will improve water quality, a key pre-requisite for improving the age structure of the population through implementation of a Betterment Plan.
Improve water quality	**None**, no change to the pearl mussel population as a viable component of the SAC. The Proposed Development will improve water quality through implementation of a Betterment Plan.
Improve channel substrate quality by reducing siltation	**None**, the structure, function and supporting processes of SAC qualifying species habitats would remain largely unchanged. However, Proposed Development will reduce siltation through implementation of a Betterment Plan.
Ensure host fish population is adequate for recruitment	**None**, no significant effects on SAC host fish populations predicted. The Proposed Development will improve water quality and instream salmonid habitats through implementation of a Betterment Plan.
Increase the amount of shading through marginal tree cover along those sections of river currently supporting this species	**None**, no loss of riparian tree cover predicted. The Proposed Development will increase riparian tree cover in several watercourse reaches through implementation of a Betterment Plan. Note, climate change threats to pearl mussels mean that increasing riparian tree cover should not be solely focussed on sections of the river supporting the species (i.e. where pearl mussels are known to be present). This approach is now known to be insufficient and beneficial catchment wide riparian tree planting is required to cool water temperatures, stabilise bankside habitats and provide additional cover for host fish populations.

- As previously discussed, the status of the pearl mussels within the Owenkillew SAC is currently unfavourable due to a range of existing catchment pressures. The Proposed Development is not likely to give rise to adverse effects on the integrity of the Owenkillew SAC, and the actions outlined in the Betterment Plan are without doubt 'no regrets' conservation measures that will benefit pearl mussels. However,

that is not to say that such beneficial actions are likely to be sufficient to bring the Owenkillew SAC into favourable condition; they are not.

- I can find no conservation objectives for the Owenreagh River ASSI but given the almost identical threats identified by JNCC (ibid) to those in the Owenkillew, the Betterment Plan measures outlined for the Owenkillew are likely to be beneficial for the Owenreagh too. Therefore, the potential impact of the Proposed Development on pearl mussels, which are only known from upstream of the Proposed Development on the Owenreagh ASSI, are not considered likely to be significant.

[11] NIEA. Owenkillew River SAC (Site Code: UK0030233) Site Conservation Objectives (v4. 2024).

Appendix 1. [redacted] Pearl Mussel Publications

- [redacted] 2022. *The Impact of a drought on key freshwater pearl mussel* Margaritifera margaritifera *populations in Scotland*. Journal of Conchology 44: 1-15.
- [redacted] 2017. *Forest management and freshwater pearl mussels: a practitioners' perspective from the north of Scotland.* Scottish Forestry 71: 14-21.
- [redacted]. 2016. *The status of the freshwater pearl mussel* Margaritifera margaritifera (L.) *in Scotland: extent of change since 1990s, threats and management implications*. Biodiversity and Conservation 25: 2093-2112.
- [redacted]. 2014. *Population size, structure and distribution of an unexploited freshwater pearl mussel* Margaritifera margaritifera (L.) *population in Scotland*. Journal of Conchology 41: 1-12.
- [redacted]. *Scotland's freshwater pearl mussels: the challenge of climate change*. In: River Conservation and Management. Wiley-Blackwell.
- [redacted]. *Wildlife Crime and Scottish Freshwater Pearl Mussels*. British Wildlife 24: 10-13.
- [redacted] 2008. *Effects of aquatic weed removal on freshwater pearl mussels and juvenile salmonids in the River Spey, Scotland*. Aquatic Conservation: Freshwater and Marine Ecosystems 18: 44-54.
- [redacted] 2007. *Recorded natural predation of freshwater pearl mussels* M. margaritifera (L.) *in Scotland.* Journal of Conchology 39: 469-472.
- [redacted] 2005. *The rediscovery of freshwater pearl mussels* Margaritifera margaritifera (L.) *in Shetland*. Shetland Naturalist 2:2 pp 57-64.
- [redacted]. 2003. *An unusual freshwater pearl mussel* Margaritifera margaritifera (L.) *population in Scotland.* Journal of Conchology 38: 139-146.
- [redacted]. 2003. *The threat of climate change to freshwater pearl mussel populations.* Ambio 32: 40-46.
- [redacted]. *Intensive searching for mussels in a fast-flowing river: an estimation of sampling bias*. Journal of Conchology 37: 309-316.

- [redacted] 2001. *A standardised method for assessing the status of freshwater mussels in clear, shallow rivers*. Journal of Molluscan Studies 67: 395-396.

- [redacted] 2001. *Conservation of threatened pearl mussel populations: river management, mussel translocation and conflict resolution*. Biological Conservation 99:183-190.

- [redacted]. *The extent of, and causes for, the decline of a highly threatened najad:* Margaritifera margaritifera. In: Ecology and Evolutionary Biology of the Freshwater Mussels Unionoidea. Eds Bauer, G and Wachtler, K Springer-Verlag, Heidelburg, Germany. Ecological Studies 145:337-357.

- [redacted] 2001. *The decline of migratory* Salmonid *stocks: a new threat to pearl mussels in Scotland*. Freshwater Forum 15: 85-96.

- [redacted]. *The status of the freshwater pearl mussel* Margaritifera margaritifera *Linn. in Scotland*. Aquatic Conservation: Freshwater and Marine Ecosystems 10:197-208.

- [redacted] 2000. *Sizes, densities and age structures of Scottish* Margaritifera margaritifera *(L.) populations*. Aquatic Conservation: Marine and Freshwater Ecosystems 10:229-247.