

An Coimisiún Pleanála
64 Marlborough Street
Dublin 1

17 September 2026

Re: ACP 324277 – Response to An Taisce Observation on the Substitute Consent Application at Ardcahan, Dunmanway, Co. Cork

A Chara,

On behalf of the applicant, Murray Brothers Tarmacadam Ltd, this letter provides a response to the An Taisce Observation received by An Coimisiún Pleanála in relation to the substitute consent application for the quarrying of rock that took place between February 1990 and October 2014 at Ardcahan, Dunmanway, Co. Cork.

The substitute consent application was submitted to An Coimisiún Pleanála (ACP) on the 6th May 2026. An Taisce submitted an observation to ACP on the 28th July 2026. A copy of this observation was received by the applicant on the 31st August 2026.

Applicant Response to An Taisce Observation

The Applicant acknowledges and has carefully considered the submission made by An Taisce and notes that the submission raises matters relating primarily to:

- Exceptional Circumstances and the Substitute Consent process;
- Water Quality, Freshwater Pearl Mussel and the Bandon River SAC;
- Historical use of Poly Aluminium Chloride (PAC);
- Historic Monitoring Records and Retrospective Assessment;
- Habitat Loss, Annex I Habitats and Biodiversity;
- Cumulative Effects and Water Framework Directive Compliance.

These matters are addressed below.

Exceptional Circumstances and the Substitute Consent Process

An Taisce questions whether the circumstances surrounding the development satisfy the statutory test for substitute consent and whether the application is consistent with the objectives of the EIA and Habitats Directives.

The Applicant notes that An Bord Pleanála previously granted leave to apply for substitute consent under Ref. ABP-305621-19, having determined that exceptional circumstances existed which justified recourse to the substitute consent process. In reaching that determination, the Board concluded that the environmental effects of the development could be assessed, that public participation could be facilitated

and that any environmental impacts could be substantially remediated. The circumstances underlying that determination remain applicable to the current application.

The Planning Statement outlines the unique planning history of the site, including:

- The established pre-1963 status of the quarry;
- Former ownership and operation by Cork County Council;
- Permission for the associated macadam plant under Ref. W/98/294;
- The Applicant's acquisition of the site in the reasonable belief that quarrying activities were authorised;
- The Applicant's subsequent compliance with the enforcement process and cessation of quarrying activity in October 2014.

This is not a case involving ongoing unauthorised development. Rather, the application relates to historical quarrying activities which ceased over twelve years ago and are now being assessed through the statutory substitute consent process. The Applicant respectfully submits that the exceptional circumstances identified previously by the Board remain applicable and continue to justify the use of the substitute consent procedure in this case.

Historic Monitoring Records and Retrospective Assessment

An Taisce suggests that the absence of comprehensive historical monitoring records undermines the retrospective assessments undertaken.

The Applicant does not accept this position.

The substitute consent process exists specifically to facilitate retrospective assessment of development where EIA and/or Appropriate Assessment was not undertaken at the time of development. The rEIAR and rNIS explicitly acknowledge limitations in historical data availability and employ an evidence-based retrospective methodology using available planning records, aerial photography, site inspections, ecological surveys, hydrological assessments, geological investigations and specialist technical expertise.

The absence of complete monitoring records is not unusual in retrospective assessment cases and does not prevent the competent authority from undertaking a robust environmental assessment where sufficient information is available regarding likely effects and necessary remediation measures.

The Bandon SAC, the Pearl Mussel population, the EPA River Risk Status, and the River Risk Ranking were all rated 'Good' which demonstrates that, despite the lack of regular monitoring data, the quarry works did not negatively impact on the local surface water environment. The lack of regular monitoring does therefore not equate to a negative impact.

Poly Aluminium Chloride (PAC)

An Taisce raises concerns regarding the historical use of PAC as part of the site's water management system.

The Applicant notes that PAC was used in very small quantities, approximately 25 litres per annum, as part of a controlled settlement pond system designed to improve water quality by promoting settlement of fine suspended solids. The use of settlement ponds, flocculants and water recycling systems was an established industry practice within the quarrying and aggregate sector during the relevant period.

Wash water was directed through large settlement ponds where suspended solids settled out. The resulting silt was contained on site and retained within the settlement system and there was no direct discharge of PAC water from the site. The wash water would have gone from settlement pond A to settlement pond B and was only released to the lower Ponds F & G from Pond B in a controlled manner. Only in very wet conditions where re-cycled water was mixed with storm water and over topped from

the lower Ponds F & G into Pond L would any PAC water be able to become part of the site's stormwater discharge. Therefore, under normal operations none of the PAC water was discharged from the site as all the wash water was recycled. On the very rare conditions when some of the settled PAC water was used in the lower ponds and became part of the stormwater flow from Pond L to the local stream, the dilution factor would have been very significant and there would have been imperceptible and negligible environmental risk.

Viridius prepared a response to a clarification request about PAC use on site under Cork County Council ref. 14/616 (item 2 of CRFI 2015), which provides further clarity on this matter (see below and appendix B attached):

Based on the wash water dilution ratios, the further dilution on site through the retention of the water through a number of ponds that are part of the sites water recycling system and the fact that aluminium ions are a risk to salmon species only at un-naturally low pH levels rather than the Bandon River SAC qualifying species of Lamprey and Pearl Mussel indicates that the potential impact of the release of compounds relating to this chemical on the adjacent freshwater system, and in particular on the qualifying features on which the SAC is designated would be considered to be imperceptible and of no to negligible risk.

The rNIS submitted with this current application specifically assessed potential ecological effects associated with PAC and concluded that the quantities used were low, heavily diluted and posed a very low risk to aquatic ecology, including Freshwater Pearl Mussel.

No scientific evidence has been submitted demonstrating that the historic use of PAC at Ardcahan resulted in significant environmental effects and no such effects were identified in the rNIS assessment.

Water Framework Directive Assessment

An Taisce suggests that a Water Framework Directive assessment is required for both the substitute consent period and the current status of the waters in the area. The rEIAR submitted included a detailed hydrology and hydrological assessment of the historic quarrying activities. In addition, further Water Framework Directive information was submitted in response to Cork County Council's report and provides further support for the conclusions of the rEIAR and rNIS.

The retrospective WFD assessment undertaken by Viridius Consulting concluded that the Bandon and Caha River waterbodies maintained Good Status during the period in which quarrying activities were occurring. The subsequent deterioration of the Bandon River occurred after cessation of quarrying activities in 2014. The assessment also confirms that groundwater quality remained at Good Status throughout the assessment period and was classified by the EPA as Not At Risk.

The assessment concluded that quarrying activities undertaken between 1990 and 2014 did not alter the quality status of either the Bandon River waterbody or the underlying groundwater body. Current EPA mapping identifies agricultural pressures as the principal risk factor affecting the catchment.

Water Quality, Bandon River SAC and Freshwater Pearl Mussel

An Taisce considers the potential impact of quarrying activities on water quality, sedimentation, Freshwater Pearl Mussel and the integrity of the Bandon River SAC.

These matters were comprehensively assessed as part of the remedial Natura Impact Statement and remedial Environmental Impact Assessment Report. The assessments acknowledge the hydrological connection between the site and the Bandon River SAC and provide detailed evaluation of potential historical effects on water quality and ecological receptors.

The assessments concluded that while quarrying activities may have contributed suspended sediment during periods of heavy rainfall, there is insufficient evidence to attribute any measurable ecological impact on the SAC to the historical quarrying activity, particularly when considered in the context of wider catchment pressures including agriculture, forestry, peat extraction and other diffuse sources of sediment and nutrient loading.

Ecological surveys undertaken during preparation of the rNIS recorded substantial Freshwater Pearl Mussel populations downstream of the quarry stream confluence, including 1,008 mussels recorded during the 2024 survey. The rNIS concludes that the quarrying activity did not adversely affect the adult pearl mussel population and that no adverse effect on the integrity of the Bandon River SAC has been identified.

Furthermore, no evidence was identified during preparation of the rEIAR or rNIS of significant biological impacts, fish kills, major pollution incidents, hydrocarbon spills or other environmental incidents attributable to the quarry during the substitute consent period. Quarrying ceased in October 2014 and environmental conditions on site have subsequently stabilised through natural regeneration. By 1997, extraction activities had moved well away from the riverbank, thereby reducing the potential for quarrying at the site to affect the river.

The Applicant respectfully submits that references in the An Taisce submission to uncertainty associated with historical datasets do not equate to evidence of adverse ecological effects. The Appropriate Assessment process requires consideration of all available evidence rather than treating the absence of complete historical monitoring records as determinative.

Habitat Loss, Annex I Habitats and Biodiversity

The Applicant acknowledges that historical quarrying activity resulted in habitat loss, including impacts on areas corresponding to Annex I Old Sessile Oak Woodland and European Dry Heath. These impacts are fully acknowledged within the rEIAR and comprise the principal significant environmental effects identified for the development.

However, it is important to distinguish between habitat clearance associated with historical quarrying activities and the quarrying activities undertaken during the substitute consent period. The site was authorised up until 28th April 2005, when the failure to register under Section 261 meant the site became unauthorised. Historic aerial photography confirms that 9.26 hectares of the extraction area (i.e. 90% of the total extraction area) had occurred prior to 2005 (refer to Table 1 of the Planning Statement submitted with the Substitute Consent application).

Historic aerial photography also confirms that significant extraction had already occurred on the site before the adoption of the Habitats legislation in 1997 (i.e. at least 6.42 hectares or 62% of the total extraction area had occurred prior to 1995), and also before the substitute consent period of 1990 to 2014 where 5.1 hectares or 50% of the total extraction area had already occurred. Consequently, the minority of the habitat loss referred to by An Taisce actually forms part of the development subject to assessment.

The Applicant further notes that the purpose of substitute consent is not to recreate the pre-development environment or provide biodiversity offsetting on a hectare-for-hectare basis. Rather, the statutory objective is to identify significant environmental effects and secure appropriate remediation measures.

To address identified effects, the application includes a comprehensive Remediation Plan providing for:

- protection of remaining woodland habitats;
- protection of existing dry heath habitat;

- wetland and pond enhancement;
- natural woodland and scrub regeneration;
- ecological monitoring;
- invasive species management and control;
- long-term habitat restoration measures.

The interaction between the Substitute Consent Remediation Plan and the Section 37L Regeneration Plan is illustrated in the combined landscape drawing, which was submitted in response to the council's report and is appended to this letter response.

Conclusion

While An Taisce raises concerns regarding water quality, ecological effects, habitat loss and the substitute consent process, these matters have been comprehensively assessed through the remedial EIA and Appropriate Assessment process.

The rEIAR, rNIS and Planning Statement demonstrate that:

- the environmental effects of the historic quarrying activities can be robustly assessed;
- no adverse effect on the integrity of the Bandon River SAC has been identified;
- quarrying activities did not alter the WFD status of local surface water or groundwater bodies;
- the use of PAC did not result in significant environmental effects;
- appropriate remediation measures have been identified to address significant historical impacts; and
- the application satisfies the statutory objectives of the substitute consent process by facilitating environmental assessment, public participation and remediation of identified effects.

Accordingly, the Applicant respectfully submits that the matters raised by An Taisce do not constitute a basis for refusal of Substitute Consent and should be considered in the context of the comprehensive environmental assessment and remediation strategy accompanying the application.

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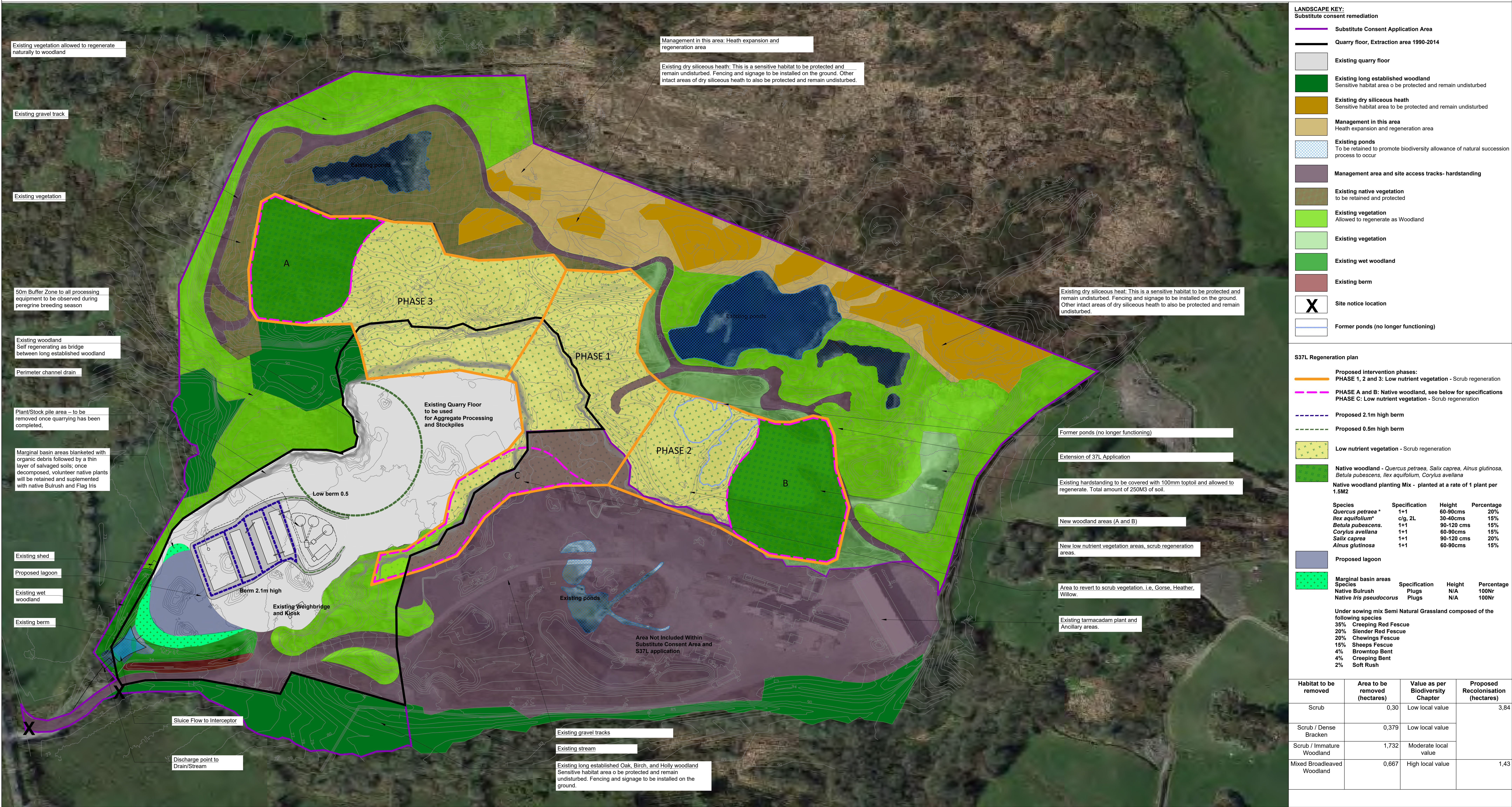
Saoirse Kavanagh

Saoirse Kavanagh

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Appendix A – Combined Substitute Consent Remediation and S37L Regeneration Plan

ARDCAHAN QUARRY COMBINED SUBSTITUTE CONSENT REMEDIATION AND S37L REGENERATION PLAN



Substitute Consent Works- Landscape Remediation

This landscape plan proposes landscape remediation measures to address significant landscape and visual related effects that have occurred between 1990 and 2014. The rEiAR identifies the historic habitat losses associated with quarrying activity and proposes a comprehensive suite of remedial measures. The guiding framework for this landscape plan is the acknowledgement of the current value of the ecological processes that have generated onsite and the facilitation of this natural succession is incorporated as a sustainable method for landscape and habitat restoration (See points 1-4 below). However, this is not merely a passive concern. Active processes such as Ecological monitoring and Invasive species monitoring and control will be engaged to promote landscape remediation (see points 5,6 below).

In short the main points of the Landscape Remediation are;

- Retention and protection of remaining woodland habitats, (see Existing Long Established Woodland in Remediation Plan)
- Retention and protection of remaining heath habitats (see Existing Dry Siliceous Heath Habitat and Management area for expansion in Remediation Plan)
- Wetland and pond enhancement (See Existing Ponds in Remediation Plan)
- Existing Native Vegetation allowed to regenerate naturally-- wet woodland and scrub vegetation
- Invasive species control
- Ecological monitoring

S37L Application – Landscape Regeneration

The proposed development comprises the extension of an established quarrying operation within a long-standing quarry site that has historically supplied aggregate materials in West Cork. The proposal seeks permission for the extraction of quartzitic sandstone within a 5.01ha extraction area over a 20-year period, with extraction phased and accompanied by progressive restoration measures. In short the main points of the Landscape Regeneration are;

- Once quarrying activities have ceased, it is proposed to use the previously excavated site topsoil (phases 1, 2 and 3) to facilitate the establishment of new woodland habitats. The addition of approx. 250mm of topsoil will facilitate the expansion of these fragmented woodland habitats. These areas have been identified to support the expansion of the Existing Long Established Woodland in the Remediation Plan, Area A, and also Area B in the S37L Regeneration Plan.
- A further area, Area C, has been identified as a transition scrub area in the supporting ecological report and this will be facilitated with the spreading of approx. 100mm of topsoil over the area. No imported seed will be brought into this area to facilitate the development of low nutrient scrub vegetation (ie Gorse, Heather and Willow).
- Incorporation of Marginal wetland basin planting as a landscape transition from the lagoon. The planting of pockets of native wetland vegetation including Bulrush and Native Flag Iris will support the development of Marginal Wetland Planting as will the sowing of a native Seminaturl grassland understorey.

Screening vegetation as well as raised berms along the southern boundary and south-western boundaries will be retained undisturbed to restrict views from the nearby receptors. Screen planting at these locations is developing well and needs to be retained as these berms merge with the existing hedgerows and peripheral scrub vegetation lending a consistent naturalistic appearance when viewed from a distance.

Conclusion

A Remediation Plan was submitted with the Substitute Consent application, and a Regeneration Plan was submitted with the S37L application. Combined these two plans provide detailed proposals for the existing and future ecology on site. The substitute consent remediation plan focuses on the lands within the northern portion of the site. While the S37L regeneration plan proposes regeneration in the centre of the site, once the proposed future quarrying has been completed. The future quarrying activity, proposed as part of the S37L application, is in the centre of the overall site to ensure minimal impact on the remediation proposed as part of the substitute consent application. The two plans work alongside each other to provide a robust proposal for the landscape and ecology on site. This composite drawing has been prepared to demonstrate how the two plans interact.

THIS IS NOT FOR CONSTRUCTION
This drawing is the property of the Landscape Architect unless otherwise stated. All dimensions are in millimetres. Where dimensions are in feet, inches, or centimetres, the metric equivalent shall be used. The drawing is for information only and does not constitute a contract. The drawing is for information only and does not constitute a contract. The drawing is for information only and does not constitute a contract.

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Client: Murray Bros. Tarmacadam Ltd.
Project: Ardcahan Quarry Combined Substitute Consent Remediation And S37L Regeneration Plan
Drawing: Landscape Layout

Date: 11/08/2026
Drawn By: Luis Medeiros
Checked By: Cathal O'Meara
Issue: Planning
Dwg No: 2009_LA001
REV 21

Scale 1:1000, @ A0

Appendix B – 2015 Clarification Response Report

2015

Ardcahan Quarry Development – RFI Clarification Responses.



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[Ardcahan Quarry Development RFI –
Clarification Responses]

[Murray Bros. (Tarmacadam) Ltd.]

[13th May 2015]

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Figure 02_ Close up of Attenuation Pond Area in SW portion of the site.

Figure 03_ Cross Section of SW corner of the site

Figure 04_ Design Drawings for the adjustable weir & penstock design

APPENDICES

Appendix A & Runoff Calculations for the Ardcahan Attenuation Pond

Appendix B & Brochure of available adjustable penstock weirs

Appendix C & Met Eireann DDF Data for the site

Appendix D & Nomogram Graph for infiltration coefficients

Appendix E & Poly Aluminium Chloride (PAC) MSDS

Appendix F & *“An overview of the ecotoxicological and environmental effects of residual coagulants and flocculants on natural waters”*

1 RESPONSE TO A REQUEST FOR CLARIFICATION

1.1 INTRODUCTION

Viridus Consulting Ltd., (VCL) have been requested to address two hydrologically related issues that have been asked for by way of a request for clarification following a previous request for further information (RFI) from Cork County Council (CCC) regarding a planning application from Murray Brothers Tarmacadam Ltd in the quarrying of stone from their quarry site located at Ardcahan, near Dunmanway in West cork.

VCL were involved in the preparation of the RFI and original hydrological and hydrogeological elements of the Environmental Impact Assessment (EIA) for the site as part of the planning application, which included the Environmental Impact Statement (EIS), for the proposed development. Planning Reference 14/00616.

The Request for Clarification letter issued by CCC, dated 29th of April 2015, identified two items that needed to be addressed. This report addresses these items as they are primarily relevant to the hydrology of the site. There was also input from the projects ecological specialist with regard to Item 2.

As requested in the clarification letter, Dr. Jervis Good of the National Parks and Wildlife Service and Sharon Casey, Heritage officer with Cork County Council were contacted to discuss the response to the clarification and their verbal comments were included in this document.

The clarification items are outlined and then addressed under individual headings below.

Supporting documents including Site Maps, (Figures 01 to 03), the penstock design (Figure 04) and Appendices A to F are submitted with this clarification letter report.

1.2 ITEM 1

Item 1 of the request for further clarification asks that:

You are required to provide additional details in relation to the design, location and scale of the attenuation pond and penstock/weir system which is proposed to be developed in the south west corner of the site. In accordance with the recommendations of the National Park and Wildlife Service, the system should be designed to accord with the standards set out in the 'Handbook of methods for controlling surface waters in and around aggregate quarries'. Please include calculations upon which the design is based to demonstrate that the system is adequately sized to ensure that there is no discharge of contaminated waters to the adjacent freshwater system.

The Surface Water Drainage System, which was mapped in detail using a drone and follow up ground surveys for the RFI is presented in Site Layout Drawing identified as Figure 001. The location of the sites attenuation pond system is located in the south west corner of the site. This area of the site is presented in a larger scale in the Pond Layout Drawing presented as Figure 002.

Two Ponds (I & J) currently provide attenuation for the water running off the western half (identified as catchment Area A4 in Figure 1) on the Ardcahan site. The water from the first pond (Pond I) percolates via a discharge overflow situated (at about 73m OD) to the second (Pond J) before it percolates through this berm (from about 72.5m OD) to a grassy vegetated marshy area in the SW corner of the site.

In order to increase the size of the attenuation area and to have more control of the potential discharge it is proposed that a water level control, (adjustable weir type system), would be installed in the berm of the first pond that would allow storage capacity of the attenuation pond to be greatly increased for periods of heavy or persistent rainfall. The area between the 73m and 74m contour line in this part of the site covers an area

of about 5,000m² so by installing an adjustable weir that would over top at 74m OD then the capacity of the pond would be increased to about the calculated volume of a 100yr storm event occurring over the whole south western portion of the site, which has been conservatively sized as being 10 Ha in area. The calculations are presented in Appendix A and a cross section of the south west corner of the berm and attenuation pond system is presented in Figure 3.

The proposed penstock weir system would have about a 1m by 1m adjustable door which would be installed in a constructed concrete chamber located in the existing berm between ponds I and J. The engineering design for the proposed outlet chamber is presented in Figure 4. These adjustable weir systems are very common in managing water levels in facilities such as water treatment plants and settlement ponds etc.. A typical product brochure for off the shelf adjustable penstocks is presented in Appendix B and it is this type of penstock weir which is proposed to be installed.

It is envisaged that the civil engineering work would take about a week to complete but would have to be undertaken during a dry summer/autumn period when the water level in the existing ponds and risk of rainfall are low. Any civils work completed in this area of the site could only be done in dry weather to reduce the risk of runoff from the works entering the down gradient watercourse.

With regard to the Handbook of methods for controlling surface waters in and around aggregate quarries which was published by the UK Mineral Industry Research Organisation (MIRO) and Department for Environment, Food and Rural Affairs (DEFRA) in 2004 the proposed surface water controls and attenuation pond system complies with and follows many of the recommendations of that publication. The quarry operation will include all the measures outlined in Section 2.3 of the Handbook document in the control of contamination and particularly sediments through:

- Segregating runoff from different areas of the site,
- Recycling process water
- Using constructed settlement ponds
- Use of flocculants/coagulants to enhance sedimentation and
- Use of vegetation to reduce sediment mobility.

The calculations used in estimating the rainfall and runoff from the site follow the format and formula presented in particular the use Met Office data, such as rainfall return period information and the use of the Rational Formula for calculating runoff. Input parameters in calculating flow rates are compliant with the Handbook as they include the surface type, surface area, infiltration capacity and slope. It is noted that in Section 4 the Handbook states that complex mathematical approaches to runoff calculations are not appropriate for the majority of quarry applications. The Met Eireann site data is presented in Appendix C.

Some of the methods outlined in the Handbook are not relevant to the Ardcahan Site as it is a small catchment (<0.5Km²) and therefore not suitable for the 1999 UK Flood Estimation Handbook (FEH) calculations while the 1975 UK Flood Studies Report (FSR) is recognised in the document as not being suitable for hard rock quarries or urban catchments. Some of the surface water flow equations presented in the document are not directly applicable to the Ardcahan Quarry site as diversion channels, culverts and soakaways are not present on the site.

By coincidence the example in the Handbook (Example 5.2 on page 57) calculating the required dimensions of an attenuation pond use a 6Ha site (with 1ha vegetated), which is the same proposed quarry area with similar 100yr storm rainfall intensities to those applicable at the Ardcahan site. The calculated pond dimensions in the example are lower than those presented by the EIS for the Ardcahan site, (2,221m³

as opposed to 3,039m³), due to the conservative assumptions used in the Ardcahan calculations, that there is no vegetative effect and that an infiltration coefficient of 0.7, equivalent to pavement or light industrial land runoff, which assumes very low levels of infiltration is used. Refer to the calculations sheet in Appendix A.

The proposed attenuation pond (I) has the dual function of providing a surface water retention structure that will help avoid flooding by providing adequate storage for runoff during 100yr rainfall events and also by controlling the potential discharge of elevated concentrations of suspended sediments or other contaminants from the site. The final discharge pond (J) acts as small settlement lagoon for the site and there is also an area (~460m²) of vegetated boggy ground which helps act as a final polishing feature. This area could be enhanced as a polishing wet land if the ground level is made consistent (i.e. no preferential flow paths such as swales or ditches are formed to the outfall), and the existing vegetation is supplemented with specific botanic species that will attenuate fine particulates such as rushes and willow etc.. (This improvement of the wetland area was discussed with Dr. Jervis Good of the NPWS as part of the clarification process).

The Rational Formula is recommended in the Handbook and this formula was used in the Ardcahan EIS. The runoff calculations used in the design of the attenuation pond and proposed adjustable weir system are summarised below and also presented in the calculation sheet in Appendix A.

The Rational Formula in the form $Q=2.78CiA$ (National Coal Board, 1982), assumes the flow (Q) is a function of the permeability and slope of the land surface (C), the rainfall intensity (i) and the area of the land (A). The runoff coefficient value (C) is a dimensionless empirical catchment runoff coefficient determined from tables (such as Table 4.1 in the Handbook) and/or from a Nomogram Graph, (as presented on Appendix D). In the case of Ardcahan a relatively level quarry floor <1% gradient (<0.01 ground slope) dominates the catchment area with a runoff coefficient of between clay and clay/loam which would conservatively represent a surface such as fractured sandstone bedrock is interpreted to have a runoff coefficient of about 0.7. This conservative value represents reasonably impermeable ground, low rainfall acceptance and high runoff potential.

The rainfall intensity (i) is taken from the Meteorological Department of Ireland (Met Eireann) which have rainfall profiles in the form of a Depth-Duration-Frequency (DDF) model for any location in Ireland. A depth duration frequency model allows for the estimation of point rainfall frequencies for a range of durations for any location in Ireland. The model consists of an index (median) rainfall and a log-logistic growth curve which provides a multiplier of the index rainfall. Rainfall station data were analysed and an index rainfall extracted. Computer applications were written to apply the model and produce outputs of the return period rainfalls (Fitzgerald, 2007).

Met Eireann were contacted to get the rainfall profile at the site location (Irish Grid: Easting: 124723, Northing: 55805). The DDF table is included in the Appendix C. The rainfall amount (mm) resulting from a 6 hours storm is listed in Table 1 for the 1 year, 30 years and 100 years return periods.

Table 1 - Depth of rainfall (mm) for different return period at the Ardcahan site

Return Period year)	6hrs Rainfall (mm)
1	31.1
30	59.1
100	72.3

It is assumed that, as rock is close to surface, the pre & post development areas would have similar runoff. The estimated volume of runoff for return period 1 year, 30 year & 100 year is presented in Table 2 below.

Table 2 - Volume estimates of pre and post development runoff from 6 hectare area

Return Period (year)	6 hrs Rainfall (mm)	Pre Development		Post development	
		Peak Runoff (l/s)	Run-off Volume (m ³)	Peak Runoff (l/s)	Run-off Volume (m ³)
1	31.1	61	1307	61	1307
30	59.1	115	2484	115	2484
100	72.3	141	3039	141	3039

The existing attenuation system in place for the established quarry for the south western portion of the site is a water settlement and attenuation pond area in the bottom corner of this area. The pond is triangular in shape and has a berm on the two down gradient sides and is open to the existing quarry floor on the up gradient side. This allows surface water to easily runoff to the pond and the size of the pond to expand and contract as the amount of runoff changes. The area that this attenuation pond services includes the established quarry floor, the access road and proposed excavation area which covers an area which is conservatively estimated to ultimately cover about 10 hectares of the total site area.

Table 3 presents the size of pond required for runoff from 10 hectares for the different return periods assuming an average depth of 1m.

Table 3 - Design dimension estimates of attenuation pond for 10 hectare area

Return Period (year)	Attenuated Volume (m ³)	Length (m)	Width (m)	Depth (m)
1	2179	46.68	46.68	1
30	4140	64.35	64.35	1
100	5065	71.17	71.17	1

An attenuation pond area of over 5000m² with an average depth of about 1m is located up to the 74m contour, as shown on Figures 1 & 2.

It is important to consider that the existing attenuation pond system that was developed in the south west corner of the site with the old quarry is of a smaller scale to that which is now proposed. Based on the water quality, micro-invertebrate studies and visual assessment of the water course the surface water discharges to the stream over the many years that the site has been in operation has not had any adverse environmental effect on the quality of the receiving watercourse.

The future quarry development plan includes the relocation of the quarry access away from the SW corner of the site to the NW corner of the excavation area within about the second year of the proposed works. This will remove all machinery traffic away from the attenuation pond area and allow the restoration of the lower SW basin as a very large attenuation pond and seasonal wet grassland habitat. These measures will increase the surface water attenuation area and introduce much more vegetation into the pond system which will further mitigate any risk of sediment runoff from the site, even for more severe rainfall events than the 100yr storm that the proposed system has been designed to accommodate.

1.3 ITEM 2

Item 2 of the clarification requests that the client provide information as:

No quantification or estimate is given for the amounts of polyaluminium chloride which are added to wash water, and no assessment is included in the Natura Impact Statement as to the potential for impacts of the release of compounds relating to this chemical on the adjacent freshwater systems, and in particular on the qualifying features for which the SAC is designated. You are therefore required to provide additional clarification to allow the Planning Authority to assess potential for impacts on the SAC that are associated with this activity.

The quarry operators have confirmed that a mixing ratio of one liter of Poly Aluminium Chloride (PAC) coagulant solution is added to a 1,000 liter water container in the wash plant and then this water is slowly added to the large volumes of process water being used to wash the aggregate. About 20 tonnes of aggregate are washed per hour and this runs for a couple of hours per week. About 25 liters of PAC are used on the site annually (about 1 litre per fortnight). The volumes are very low as not all quarried aggregate material needs to be washed. The very small quantities of coagulant are currently added to the wash water to ensure the settlement of fine particulates out of suspension after washing particular grades of the finer sand material.

PAC coagulant and similar flocculent products are very commonly used in water treatment plants including quarries, construction sites, waste water treatment facilities and drinking water supply treatment plants. As indicated in Section 12: Ecological Information of the MSDS for PAC it is identified as not classified to be hazardous to the environment, not to be very persistent or very bio-accumulating. Toxicity values of >1,000mg/l for fish and >160mg/l for aquatic invertebrates are quoted which would be orders of magnitude higher than the dilution factors applied to the quarry wash water. A copy of a PAC MSDS is presented in Appendix E.

The main potential identified for adverse environmental impact from the use of PAC or similar coagulant/flocculent products is that they can reduce the pH of water and if released into a very low pH environment (pH 5 to 5.5) the aluminum ions may be harmful to salmon species. There is no evidence of acidic or low pH waters on the quarry site or in the adjacent water course or in the wider Bandon river catchment. Site specific water samples from the adjacent water course upstream and downstream of the site had pH values of 7.5 and 8.15 respectively, (refer to section 6 of the EIS).

On the Ardcahan site all wash water is pumped up gradient from the wash plant to Pond A which has a large holding capacity (~1,000m³). Typically wash water in Pond A is retained but in wet weather conditions can overflow to Pond B, which also has a large dilution capacity (>870m³). Surface water from Pond B can be returned back down to Pond G via a manually operated discharge valve when water is needed for on-site processes such as dust suppression, bitumen cooling and/or as wash water. This water retention in Pond A, dilution with rainfall runoff and overflow to retention Pond B ensures sediment settlement and that no particulates are re-circulated down to pond G in the lower part of Catchment Area 3.

Water from Pond G is recycled to the wash water holding pond (Pond K) or directly to the wash plant as necessary. The water recycling and multi pond attenuation system ensures that there is no lowering of the pH of water on the site and that no elevated coagulant/flocculent chemicals can occur in the quarries surface water. The various ponds are identified on Figure 1. (Photographs of each pond were included in Appendix A of the previous RFI response).

A recent research paper on “An overview of the ecotoxicological and environmental effects of residual coagulants and flocculants on natural waters”, completed by Boffa Miskill Ltd. For Auckland District Council (circa 2004), identified that:

- There appears to be a small risk to the natural aquatic environment arising from potential losses of unbound residual flocculants from treatment ponds on construction sites. Impacts are likely to be low level and also likely to not be significant in relation to other factors which govern the health of aquatic communities. The benefit of reduced sediment levels in discharges is considered to outweigh the risk of any low level impacts attributable to residual flocculants.
- Polyelectrolytes are reported to have low mammalian toxicity and are generally considered to be innocuous in field situations. Aluminium coagulants also generally pose a small environmental risk at normal field pH (Polyelectrolytes can occur in some common, non-PAC flocculent/coagulants).
- Aluminium in flocculated sludge is tightly bound under a wide range of redox conditions and is stable other than in severely acidified situations. The latter conditions are unlikely to occur naturally or be induced by the use of aluminium flocculants which themselves reduce pH.

The full research paper is presented in Appendix F of this document.

It should be noted that the sediment type that originated from rock excavations in this type of sandstone quarry tends to be dominated by quartz rich fine sands and silts which tend to settle out of the water column more quickly than the very fine colloidal clay particulates associated with earth works and construction sites. The use of a PAC coagulant, (or other similar available industrial coagulant/flocculate products), ensures that any fine particulates from the wash water settle out of suspension when discharged into Pond A.

The acidification of watercourses, which can result in the leaking of high metal concentrations such as aluminium from soils, has led to the mortality and population declines of freshwater pearl mussel *Margaritifera margaritifera* in northern Europe (see Degerman *et al.* 2009)*. A study by Taskinen *et al.* in 2011**, has found that acidic watercourses (*i.e.* low pH), combined with high metal concentrations of Iron (Fe) and Aluminium (Al) limits the survival of the glochidia (or larval) stage for *Margaritifera* prior to attachment to host fish, but not the glochidia stage when attached to their host fish or at juvenile stage. There are no studies to date that suggest a particular issue between aluminium and lamprey species. In relation to the Ardcahan quarry site and associated watercourse/Bandon River catchment, there is no evidence of acidic waters which would facilitate the presence of elevated concentrations of aluminium ions.

*Degerman, E., Alexanderson, S., Bergengren, J., Henrikson, L., Johansson, B-E., Larsen, B.M. & Söderberg, H. 2009. Restoration of freshwater pearl mussel streams. WWF Sweden, Solna.

**Taskinen, J., Berg, P., Saarinen-Valta, M., Väilä, S., Mäenpää, E., Myllynen, K. And Pakkala, J. 2011. Effect of pH, iron and aluminum on survival of early life history stages of the endangered freshwater pearl mussel, *Margaritifera margaritifera*. *Toxicological and Environmental Chemistry* 93(9): 1764-1777.

Based on the wash water dilution ratios, the further dilution on site through the retention of the water through a number of ponds that are part of the sites water recycling system and the fact that aluminium ions are a risk to salmon species only at un-naturally low pH levels rather than the Bandon River SAC qualifying species of Lamprey and Pearl Mussel indicates that the potential impact of the release of compounds relating to this chemical on the adjacent freshwater system, and in particular on the qualifying features on which the SAC is designated would be considered to be imperceptible and of no to negligible risk.

Appendix C – Site Layout

