GREGOR CAMERON
CONSULTANCY LTD

Dalavich Community Hydro
Hydrology Report

September 2013

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Dalavich Community Hydro
Hydrology Report

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1. INTRODUCTION

1.1 Terms of Reference

EnviroCentre Ltd have been commissioned by Gregor Cameron Ltd, on behalf of Dalavich Improvement Group, to provide support with respect to the proposed development of a run-of-river hydropower scheme on the River Avich, Argyll.

1.2 Scope of Report

The aim of this report is to assess the hydrology of the site with respect to the feasibility of a hydropower scheme at Dalavich, through desk study and a site visit.

1.3 Methodology

The following methodology has been adopted in the development of this report:

- Consultation with SEPA and reference to SEPA guidance regarding run-of –river hydropower schemes;
- Site walkover visit;
- Hydrological analysis to determine the flow regime within the River Avich; and
- Outline calculations to determine the potential power generating capacity of the proposed scheme.

2. SITE DESCRIPTION

2.1 Location

The village of Dalavich is situated to the west of Loch Awe in Argyll & Bute, and the River Avich is situated around 500m to the north (**Figure** 2.1). The river drains from Loch Avich and flows eastwards for around 2.3km into Loch Awe, with a total drop in elevation of approximately 60m. The dominant land use in the area is coniferous plantation, although there is a narrow corridor of broadleaved woodland along much of the length of the River Avich.

A site visit was undertaken on 23rd January 2013 to inform the initial hydrological assessment and power calculations provided in this report. Photographs taken during the site visit are included in Appendix A.

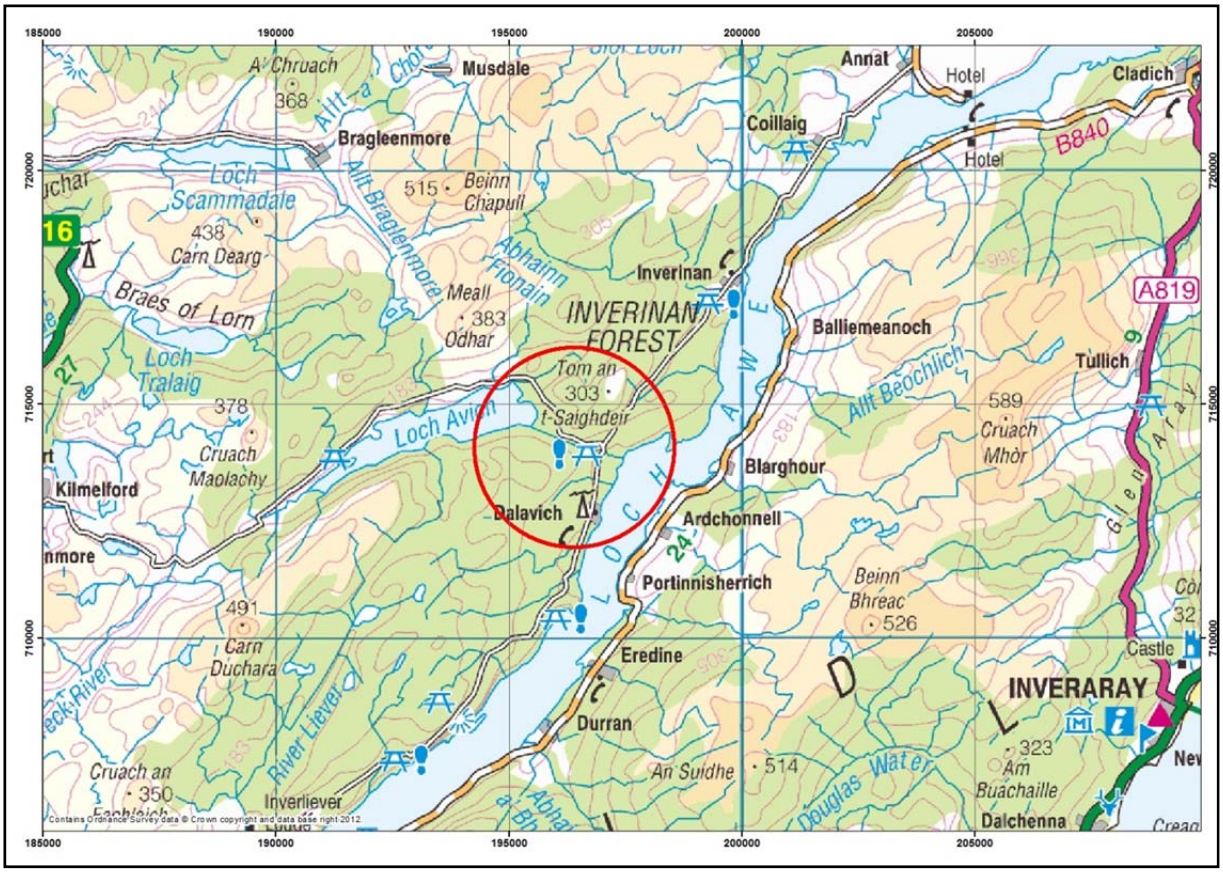


Figure 2.1: Dalavich General Location Map

2.2 Proposed Scheme

Two intake options have been considered for this scheme: option 1 near the outflow of Loch Avich and option 2 approximately halfway down the river (see Appendix B). Intake 2 is located at the former intake of a disused hydropower scheme. Both proposed scheme options would share an outfall location with the former scheme.

The key parameters of the options are provided in Table 2.1. Although option 1 has potential for higher power production, due to environmental sensitivities at the site option 2 is the preferred option.

Table 2.1 Key Parameters of Scheme Options

Parameter	Option 1	Option 2
Head (m)	46	20
Penstock length (m)	1,750	420
Affected channel length (m)	1,735	400
Channel slope (m/m)	0.03	0.05
Upstream catchment area (km^2)	29.79	31.43

Option 2 has been progressed for further assessment as due to the sensitive nature of the site in relation to bryophytes, a scheme with a shorter depleted reach would have a lesser impact on bryophytes plus it is considered that the environment has adapted to the previous hydro scheme.

3. HYDROLOGICAL ASSESSMENT

3.1 Legislative Background

The Water Environment and Water Services (Scotland) Act 2003
The Water Environment and Water Services (Scotland) Act 2003 (WEWS) is the enabling act within Scotland for the Water Framework Directive 2003 (WFD). As stated on SEPA's website, WEWS gave Scottish ministers powers to introduce regulatory controls over water activities, in order to protect, improve and promote sustainable use of Scotland's water environment. This includes wetlands, rivers, lochs, transitional waters (estuaries), coastal waters and groundwater.

The Water Environment (Controlled Activities) (Scotland) Regulations 2011 (CAR)
CAR established the authorisation regime for regulating activities which may affect Scotland's water environment. CAR is a secondary piece of legislation introduced once WEWS has been passed which enables SEPA to regulate discharges, disposal to land, abstractions, impoundments and engineering works through licensing. Hydroelectric schemes are therefore regulated under CAR with schemes of installed capacity ≤ 100kW requiring a simple licence.

3.2 River Morphology

The River Avich was observed to be deeply incised at points with significant waterfalls along its length which would pose barriers to upstream fish migration. The first significant waterfall upstream from the watercourse's outfall to Loch Awe is approximately 10m in height and is located approximately 1km upstream from the outfall to Loch Awe. Relatively straight and stable sections of the river suitable for a tailrace were observed, as was a location suitable for intake above the Avich Falls (utilising the existing weir structure). River morphology was assessed to be of SEPA River Type A (bedrock, cascade) with solid exposed rock on the channel and banks.

3.3 Flow Assessment

Hydrological assessment of the option 2 scheme was undertaken by EnviroCentre Ltd using Low Flows 2 which produced a Flow Duration Curve (FDC) for the River Avich at the proposed intake location (Figure 3.1). Further details of the FDC are contained in Appendix C.

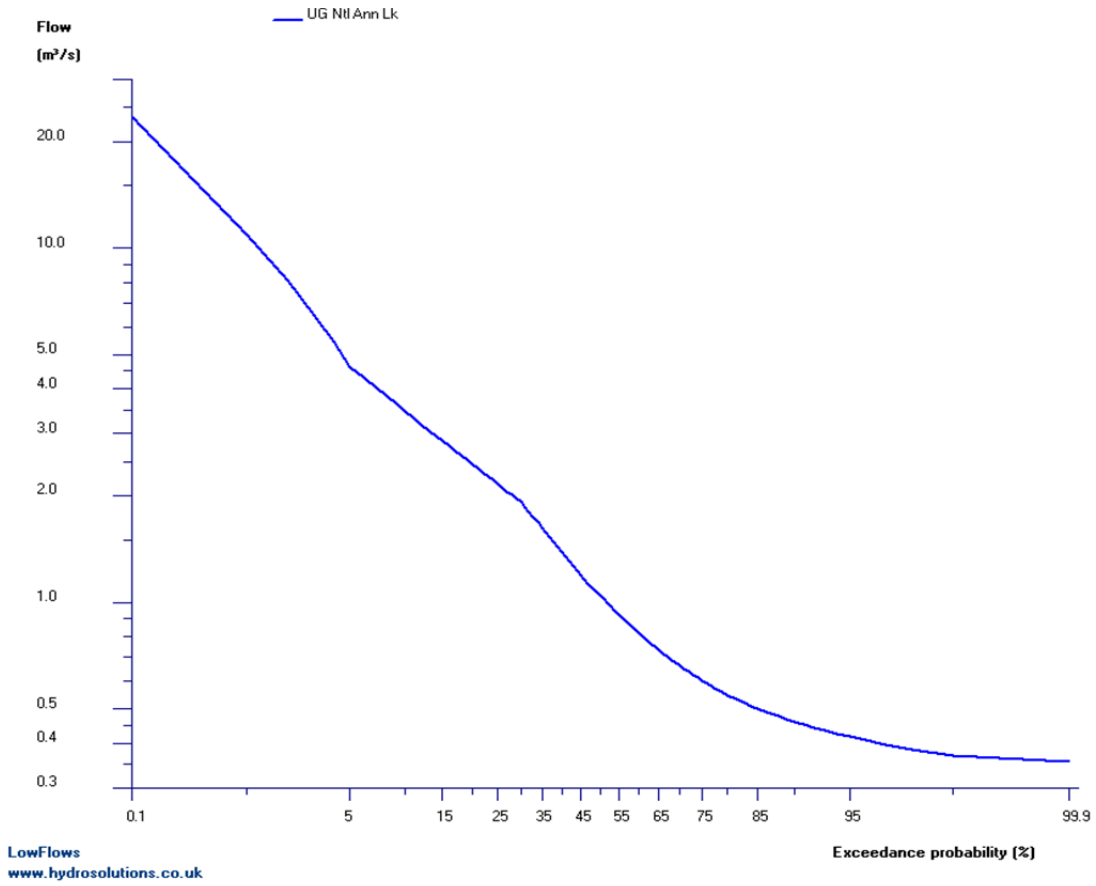


Figure 3.1 Flow Duration Curve for Option 2

The options appraisal has been extended to examine the potential influence of varying design flows. Design flows are generally based upon an estimate of mean flow predicted in the watercourse. Depending upon the sensitivity of the watercourse, there may be scope to base the design flow of the scheme on 100%, 120% or 150% of mean flow. In terms of an FDC, these values in general equate to Q_{30}, Q_{25} and Q_{20} (the flow that is exceeded 30%, 25% and 20% of the time), respectively. Compensation flows (assumed to be Q_{95} in this case) are subtracted from each of these to derive design flows (Q) for the scheme. Key flows for option 2 are provided in Table 3.1.

Table 3.1 Key flows from Flow Duration Curve

Exceedance percentile (%)	Option 2 (m^3/sec)
Q_{20}	2.461
Q_{25}	2.159
Q_{30}	1.926
Q_{80}	0.548
Q_{90}	0.460
Q_{95}	0.418

3.4 Power Generation Potential

Potential power generation calculations have been undertaken allowing for practicable mitigation measures[1] likely to be required by SEPA. These measures are summarised in Table 3.2.

Table 3.2: SEPA Hydropower Scheme Mitigation Measures

Purpose	Mitigation (summarised)
Protection of low flows	No abstraction at or below hands-off flow. • Upstream catchment area <10km^2: Hands-off flow Qn_{90} • Upstream catchment area >10km^2: Hands-off flow Qn_{95}
Protection of flow variability	When flow upstream of intake would be Qn_{30}, flow downstream should be Qn_{80}
Protection of high flows	• For schemes with annual output < 0.35 GWh, maximum allowable abstraction likely to be 1.3x Average Daily Flow (ADF) • For schemes with annual output ≥ 0.35 GWh, maximum allowable abstraction likely to be 1.5x ADF.

Other factors influence the allowable abstraction regime so Table 3.1 is intended to provide a guide only as to the likely allowable abstraction regime. Applying the mitigation measures to the scheme allows the likely abstraction regime to be refined as shown in Tables 3.4 and 3.5.

Table 3.3: Mitigation Parameters Summary

ADF (from Low Flows assessment)		1.941 m^3/s
Upstream catchment area		31.43 km^2
Flow thresholds	Qn_{95} (hands-off flow)	0.418 m^3/s
	Qn_{80} (compensation flow when river flow at Qn_{30})	0.548 m^3/s
	Qn_{30}	1.926 m^3/s
Potential annual output		≥ 0.35 GWh
Abstraction Scenarios	ADF	1.941 m^3/s
	1.3x ADF	2.523 m^3/s
	1.5x ADF	2.912 m^3/s

Table 3.4: Potential Abstraction Regime

Flow Rate	Natural (m^3/s)	Maximum Available for Abstraction (m^3/s)		Residual (m^3/s)	
		1.5x ADF	1.3x ADF	1.5x ADF	1.3x ADF
Q_5	4.629	2.910	2.523	1.719	2.106
Q_{10}	3.468	2.910	2.523	0.558	0.945
Q_{20}	2.461	1.913		0.548	
Q_{30}	1.941	1.393		0.548	
ADF	1.926	1.378		0.548	
Q_{40}	1.384	0.966		0.418	
Q_{50}	1.044	0.626		0.418	
Q_{60}	0.819	0.401		0.418	
Q_{70}	0.663	0.245		0.418	
Q_{80}	0.548	0.130		0.418	

[1] SEPA Guidance for developers of run-of-river hydropower schemes

Flow Rate	Natural (m^3/s)	Maximum Available for Abstraction (m^3/s)		Residual (m^3/s)	
		1.5x ADF	1.3x ADF	1.5x ADF	1.3x ADF
Q_{90}	0.460	0.042		0.418	
Q_{95}	0.418	0		0.418	

The maximum allowable abstraction is indicated to be 2.91 m^3/s and the associated maximum power output is as shown in Table 3.5. The annual power output has been predicted on the basis of the capacity of the scheme throughout the year, with two adjustments to ensure that the estimates are realistic. Based on previous EnviroCentre experience of a similarly sized micro hydropower scheme, a capacity factor of 50% has been assumed for the proposed scheme at average flows but at as turbine generation efficiency reduces with increasing power rating, capacity factors of 35% and 45% have been assumed for the maximum abstraction. The capacity factor, however, should be confirmed through further analysis. Post-construction of the proposed scheme, it is envisaged that maintenance requirements may require the scheme to be offline for approximately 1 week annually.

Design flows were used to calculate an outline power rating for the scheme as follows and as shown in Table 3.5:

$P = n\rho gQH$

Where
P power (kW)
n efficiency (assumed to be 0.64)
ρ density of water (1000 kg/m^3)
g acceleration due to gravity (9.81 m/s^2)
Q flow (m^3/s)
H head difference (20 m)

Table 3.5: Maximum Allowable Power Generation Potential

Design flow basis	Abstracted Q	Residual Q	P (kW)	Capacity Factor	Annual Power Output (GWh)
ADF	1.941	0.548	174.9	0.50	0.751
1.3x ADF	2.523	0.945 – 2.106	316.8	0.45	1.225
				0.35	0.953
1.5x ADF	2.910	0.558 – 1.719	365.4	0.45	1.413
				0.35	1.099

While a maximum abstraction of 1.5x ADF is likely to be acceptable to SEPA, in practice 1.3x ADF is considered to be a more realistic and more frequently achieved maximum abstraction flow, hence its inclusion in Table 4.5 for comparison purposes.

The maximum allowable abstraction on this basis is indicated to be 2.523 m^3/s and the associated maximum power output is as shown in Table 3.5 (units as shown above in Section 3.4). As turbine generation efficiency reduces with increasing power rating, a capacity factor of 35% has been assumed for the maximum abstraction.

Based on the above assessment and assumptions, it is considered likely that a scheme with a power generation potential of at least 316.8 kW is achievable for the site. Further assessment is required to optimise the size of scheme possible. It should be noted, however, that the maximum abstraction only occurs when flow in the watercourse is at the level that is exceeded 10% of the time.

3.5 SEPA CAR Screening Checklist

Assessment of the preferred scheme (option 2) has been carried out by EnviroCentre Ltd in relation to the Guidance for developers of run-of-river hydropower Schemes Part A Annex A checklists (see Table 3.6).

According to Guidance for developers of run-of-river hydropower schemes Part A Table 1, the proposed scheme, which produces > 0.35 GWh, satisfies the following requirements:

- Satisfy the criteria described in the checklists in Annex A;
- Incorporate the mitigation described in Part B (compensation flow); and
- Not cause significant adverse effects on the interests of other users of the water environment.

On the basis that the proposed abstraction rates will be appropriately sized to avoid a significant deterioration in terms of waterbody status, it is considered likely that the scheme is provisionally acceptable to SEPA.

Table 3.6: SEPA Checklist D: All Other Proposals

No.	Criterion	Dalavich Option 2	Action if Yes	Action if No
1	Will the scheme be powered by the flow of water through an existing weir or dam (i.e. without removing water from the river channel)?	No	Provisionally acceptable	Go to 2
2	Will the scheme be powered by water flow from an existing outfall?	No	Provisionally acceptable	Go to 3
3	Will the scheme be powered by water that is abstracted from immediately above a drop (e.g. a waterfall, cascade or weir) and returned immediately below that drop?	No	Provisionally acceptable	Go to 4
4	Is the proposal located on a minor tributary of a water body (i.e. a tributary with a catchment area of < 10 km^2) (information available from SEPA)?	No	Go to 7	Go to 5
5	Is the water body at high status?	Yes	Go to 7	Go to 6
6	Is the distance between the intake and the tailrace (excluding any part of that distance that is on a minor tributary) together with any reaches impacted by other activities < 500 metres?	Yes	Go to 7	Go to 8
7	Will the scheme use only the proportion of the flow in the river or stream at any one point in time that can be abstracted without causing a breach of the river flow standards for high?	Yes	Provisionally acceptable	Provisionally unacceptable if annual output is <0.35 GWh

The checklists form a CAR screening document which was submitted to SEPA's virtual permitting team for an initial opinion regarding scheme viability under the CAR Regulations. SEPA confirmed that the scheme is potentially acceptable provided that river flow standards for High are not breached by abstraction. SEPA's water resources team confirmed that the flow standards for High for the River Avich are as shown in Table 3.4:

Table 3.7: SEPA Checklist D: All Other Proposals

Flow range	Allowable Abstraction for High Standards
Flows ≥ Qn60	10% of daily flow
Flows < Qn60 to Q70	10% of daily flow
Flows <Q70 to Q95	10% of daily flow
Flows < Q95	5% of **Qn95**

Applying the Allowable Abstraction for High Standards regime to the likely power generation calculations resulted in the power output of the scheme reducing to below 0.35 GWh per year, making the scheme provisionally unacceptable to SEPA under the Annex A checklists. Further consultation with SEPA's virtual permitting team and reference to the *Guidance for developers of run-of-river hydropower schemes*, however, suggested the scheme could be provisionally acceptable provided it satisfied the following criteria:

- Annual output >0.35 GWh;
- Incorporation of the mitigation described in Part B (compensation flow); and
- Scheme does not result in sufficiently adverse impacts on the water environment to cause deterioration of the status of the water body

Incorporating the Part B mitigation measures (compensation flow regime of Qn_{95} rising to Qn_{80} at upstream flow of Qn_{30}) results in an annual output of >0.35 GWh. In addition, as the impacted reach (the length of watercourse between the intake and tailrace) is less than 500m, there would be no deterioration of the status of the waterbody. Following confirmation of that the proposed scheme would satisfy these criteria, SEPA confirmed that the proposal is provisionally acceptable to them. A copy of the correspondence with SEPA is included in Appendix D.

4. RISKS TO THE WATER ENVIRONMENT & MITIGATION MEASURES

The construction works that require to be undertaken for the Dalavich Scheme have the potential to cause pollution or impact on the bed and banks of the watercourse and on the quality and quantity of the water. These works will be authorised through a simple licence under CAR, which places a legal responsibility on the responsible person to ensure that works are taken out as documented and all reasonable measures are undertaken to prevent adverse impact to the watercourse.

The main impacts to the water environment that could occur due to construction activities are:

- Production of silt or fine sediment;
- Oil or fuel spillages; and
- Pollution due to concrete/cement.

The route of the access track is not yet known. Once the detailed design of the scheme and access routes are known, any potential effects can be assessed.

The main risk to the water environment during operation of the hydro scheme is the reduction in flows in the affected reach of the River Avich. This effect on the water environment has been minimised through design including allowable abstraction flows described in the previous section and is not considered to be significant.

The works will be carried out in accordance with the general best practice guidelines set out in Pollution Prevention Guidelines and by SEPA & SNH:

- PPG 1 General guide to the prevention of pollution
- PPG 5 Works and maintenance in or near water
- PPG 6 Working at construction and demolition sites
- PPG 7 Refuelling facilities
- PPG 26 Drums and intermediate bulk containers
- SEPA Technical Guidance Note – On-site management of Japanese Knotweed and associated contaminated soils
- SNH best practice will be followed on site during construction, for example covering holes/placing escape ramps and sealing pipes at the end of each day
- Any conditions accompanying the CAR licence

Construction activities will be managed under a Construction Environmental Management Plan (CEMP) and overseen by an Ecological Clerk of Works (ECoW).The site specific mitigation measures that will be included within the proposed works to reduce the potential pollution risks from each of the above sources are detailed in Table 4.1.

A surface water cut off ditch will be constructed around the site compound to prevent any clean water flowing across the site.

Welfare facilities will include a chemical toilet/portaloo which will be routinely serviced to remove sewage off site. Site water supply will be via a trailer bowser and bottled water made available.

Table 4.1: Sources of Risk and Mitigation Measures

Source of Risk	Mitigation Measures
Silt or fine sediment entering watercourses: Generated by surface water runoff from working area. Results in: • Discolouration. • Increased sediment load. • Downstream deposition of fines. • Local impact on aquatic ecology due to reduction of light in water and deposition on bed.	• The majority of the works to be constructed in dry conditions away from flowing water. • The areas of topsoil strip to be progressive, reducing the relative area and times of disturbed ground exposed through the duration of the works. • Formation of tracks to include suitable cambers and cross-drains to ensure they do not form drainage channels. • Excavation activities will replace pre-existing turf as part of restoration, minimising any areas of exposed soil. • All the works will be supervised by personnel experienced in working within rivers and having been involved in similar works over recent years.
Oil or fuel spillage: Storage and refuelling activities. Plant working near watercourses.	• All fuel storage on site to be bunded, placed on an impermeable surface and be compliant with the Water Environment (Oil Storage) (Scotland) Regulations 2006. • All fuel to be stored at least 10m away from watercourses. • All refuelling of plant to be undertaken at least 10m away from the burn using a drip tray with suitable capacity as set out in PPG26. • A spill kit to be available for plant on site. • All plant to be inspected to ensure that they are clean with no leaks.
Concrete/cement: Construction of intakes, header pond, thrust blocks, tailrace channel, scour protection and power house.	• All concrete pours to be undertaken in dry conditions where possible. • All formwork to be tightly sealed and tested to prevent leakage. • Relatively small quantities of concrete used. • Bulk of concrete used in areas where no surface water drains are present.

Successful implementation of the mitigation measures will reduce the risk of pollution to the River Avich as a result of the site works. All of the recommended mitigation measures as set out in Table 4.1 will be monitored as part of the supervision of the overall works, which will be undertaken by the contractor. Should any pollution incidents occur as a result of the site activities, SEPA will be contacted.

Access Tracks

The main site access will be clearly marked as a construction access point. Existing hill tracks will be used and upgraded as necessary for the construction. New tracks will be formed above the pipeline routes, which will be reinstated to a narrow width capable of being used by a small all-terrain vehicle, such as a quad bike.

When developing the access tracks, a formal drainage system will be formed, including ditches, camber to shed water to the edges, frequent cross drains and trackside grips/offlets to prevent the tracks acting as a preferential drainage route and to protect the water environment. Any trackside discharge should pass through a silt trap or other similar measure in line with Sustainable Drainage System (SuDS) principles and spread over a buffer area before flowing into a defined watercourse. Water should not be allowed or encouraged to pond in the road where possible.

Water Crossings

Track water crossings will be temporary and comprise of a steel or twin wall culvert secured in place with sand bags. All temporary water crossings will be in accordance with CAR General Binding Rule 6 (GBR6 below).

GBR6: Minor bridge construction. A minor bridge is defined as a bridge having no part of its structure within the channel of a river, burn or ditch and constructed for the purpose of supporting a footpath, cycle route or single-track road.

Rules:

1. The works must not prevent the passage of migratory fish.
2. The works must not result in the heightening of any bank or the narrowing of the watercourse.
3. Within 12 months of the work starting, the bed and banks of the river, burn or ditch must be reinstated to their previous condition as far as possible.
4. All reasonable steps must be taken to ensure that the works do not result in increased erosion of the bed and banks of the river, burn or ditch.
5. There must be no construction in the channel. This means the bed and banks of the watercourse.
6. The abutments and support for the bridge should be set-back from the channel edge.

GBR6: Temporary bridge construction or removal. In addition to the conditions above for minor bridge construction, the following will apply.

Rules:

1. The GBR applies only to temporary bridges over a river less than 5m wide.
2. Temporary bridges should only be in place for less than 12 months.
3. If the temporary bridge involves the construction of a culvert, the culvert must not extend more than 10m along the length of the river, burn or ditch.
4. Any culvert used should not result in the narrowing of the watercourse (ie its diameter should exceed the natural channel width).
5. Within 12 months after the removal of the bridge, the bed and banks must be reinstated to their condition before the works started.

Any water crossings will avoid sensitive locations, areas which could lead to excessive ponding upstream, and necessary sand bag headwalls will be used to form mud splash guards to preserve the water environment in sensitive areas. Cut-off drains will be installed to intercept uncontaminated surface water and directed around any works thereby preventing it from entering the working area.

Water Intake

The area of the bed where the intake will be constructed will be worked in the dry. A temporary cofferdam will be formed around the works area using either native material or sand bags. The water will then be diverted around the works, by pumping. Any material placed within the channel during the construction of the temporary works will be removed as soon as its function has been fulfilled in a manner which minimises pollution.

Concrete Works

For the works that require concrete (primary intake and thrust blocks) concrete will be pre-mixed off site and transported dry to the works area where water will be added to the pre-mix and the concrete mixed close to the point of use.

Concrete at the turbine house will be delivered as readymix and poured for large volumes, with blockwork mortar being mixed as required on site. The concrete works will be poured into dry workings and the formwork will be tightly sealed to ensure that there are no concrete leaks to the water environment. All washing of equipment shall be undertaken in a closed system and any discharge of washings must be to land at a distance greater than 10m from any open water.

Once settled, the clean water from concrete washings will be pumped out to the wider area within the watercourse and the residual material will be excavated and removed from the hill by dumper. This residual material will be disposed of to land where contours are leading away from any watercourses with supervisory control in accordance with GBR16 (below). Any breach of GBR16 may result in this activity requiring a licence.

GBR16: Direct discharge of pollutants into groundwater as a result of construction or maintenance works in or on the ground, which come into contact with groundwater.

Rules:

1. No solid or liquid materials coming into contact with groundwater shall contain substances listed in CAR Schedule 2. This is with exception to drilling fluids used during the works, provided they do not result in pollution of the water environment.
2. No materials coming into contact with groundwater shall cause pollution of the water environment.

Pipework

The excavations from the pipeline will be placed temporarily on the downslope while the pipe trench is prepared to place the pipe. They will be sealed as soon as practical after deposition and until re-use for infilling to ensure quick stabilisation. The excavated turf will be placed on the top side of the excavation for use as reinstatement and used to reinstate the downslope of the reinstated track over the pipeline. The infill material will only use inert and non-toxic material, preferably the initial material.

Directional drilling maybe employed where possible and appropriate for deeper sections of the penstock.

The pipeline will be prevented from acting as a drainage conduit when open by having regular offlet drains leading from it to allow water to be attenuated and pumped out as necessary.

Tailrace

A tailrace will be formed between the discharge from the turbine at the powerhouse and the final discharge back to the River Avich.

The tailrace downstream will be an open ditch. The line of the ditch and area for placement of arisings will be stripped and the turf set aside for use in restoration. The ditch will be excavated, the arisings landscaped nearby and the turf reinstated to the banks of the ditch.

At the discharge point, a 20mm fish screen will be constructed as per the CAR requirements.

Refuelling

All refuelling and maintenance of plant and machinery to be carried out in line with PPG7 and PPG26. The main refuelling point will be at the site compound. Fuel deliveries will fill portable bunded bowsers at the compound on a designated impermeable and bunded area. Machinery will be refuelled from the compound where possible.

Fuel will be transported to where the machines are working by a suitable vehicle such as a tracked dumper. Refuelling from the portable bowser to individual machines will use drip trays and have spill kits available with each machine, and be at least 10m away from any open watercourse.

All machinery used on site shall be regularly maintained and inspected for leaks. Any leaks identified must be stopped, contained and repaired.

In the event of an accidental spillage of any polluting substance or the pollution of the water environment, the contractor will immediately notify the Project Manager and thereafter SEPA. Any works directly associated with the cause of the incident will be halted, the effects mitigated where possible and measures put in place to prevent recurrence.

APPENDIX A

Site Photographs

Photograph 1 – Proposed intake location at existing weir on River Avich

Photograph 2 – Proposed intake location at existing weir on River Avich

Photograph 3 – Proposed intake location at existing weir on River Avich

Photograph 4 – Avich Falls

Photograph 5 – Proposed pipeline route

Photograph 6 – Proposed pipeline route

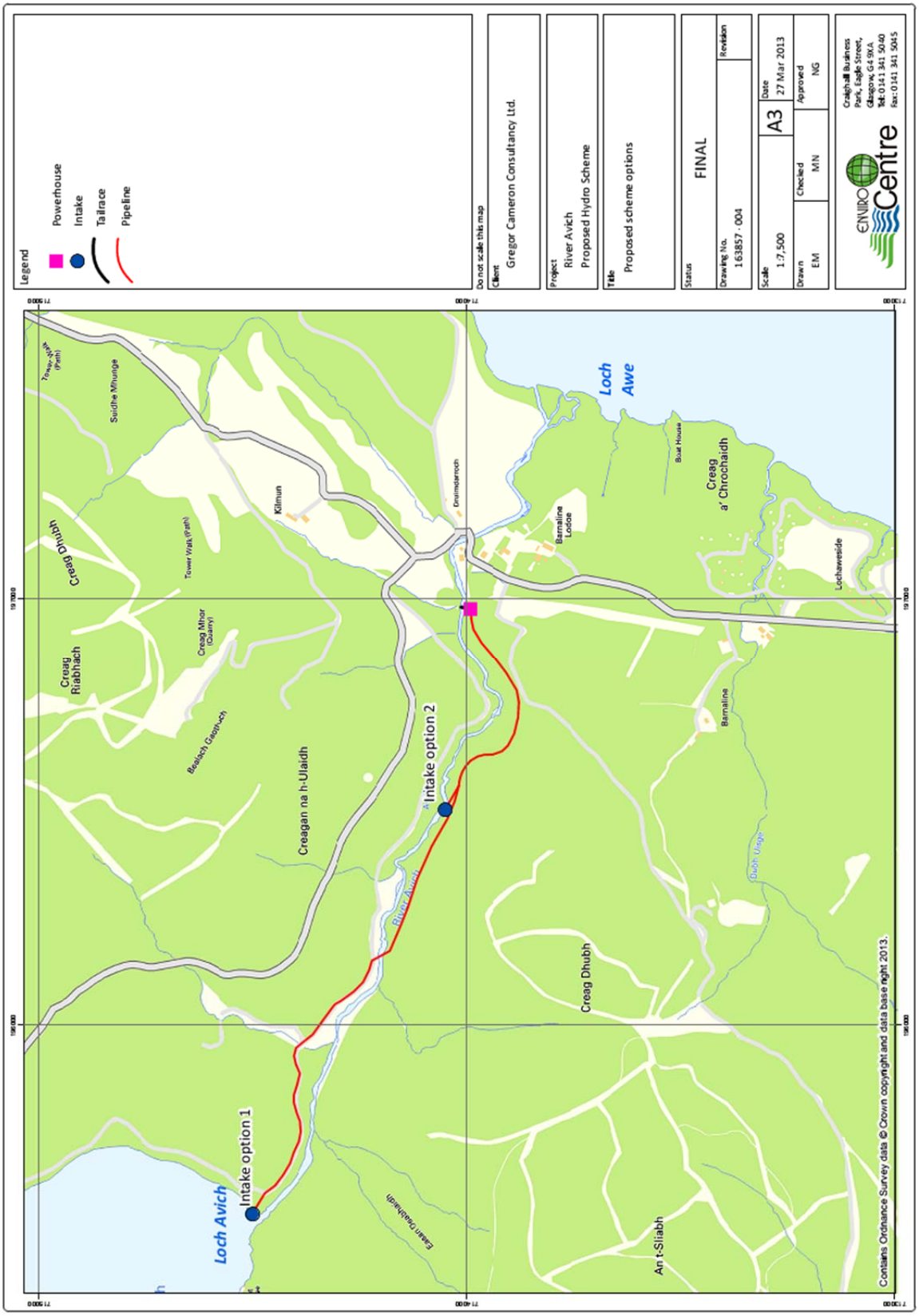
Photograph 7 – Proposed powerhouse location

Photograph 8 – Existing disused powerhouse

Photograph 9 – Proposed discharge location on River Avich

Appendix B

Intake options



Appendix C

Flow Duration Curve for Option 2

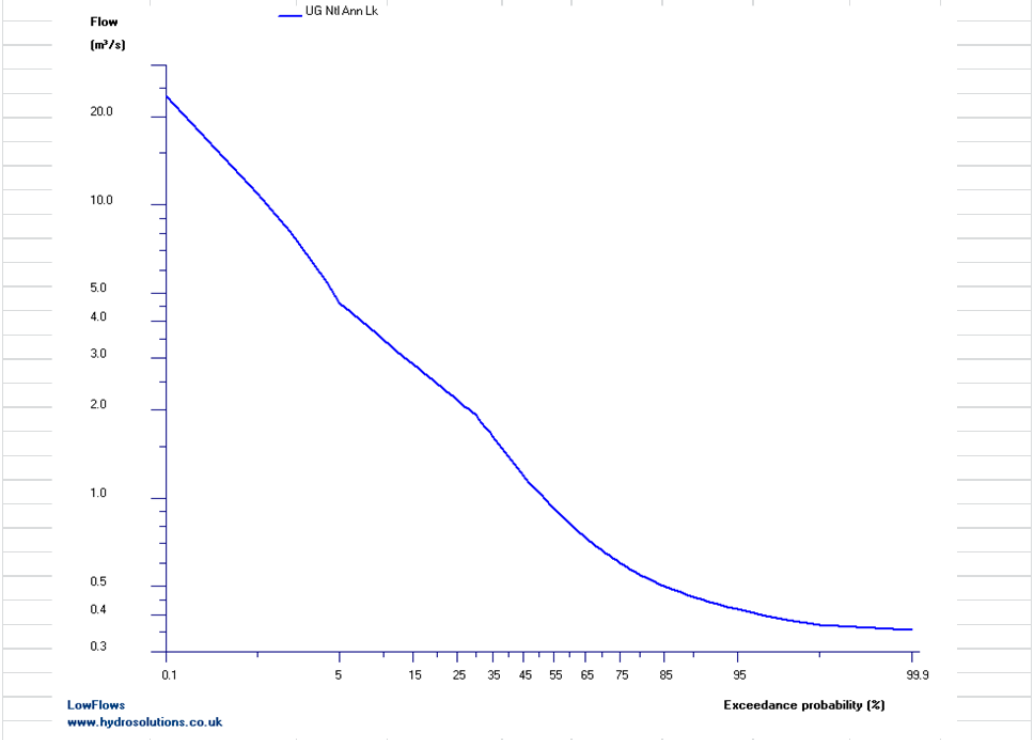
Low-Flow Estimates from LowFlows
www.hydrosolutions.co.uk

Project Title:	Dalavich Intake 2		
Project Number:	163857		
Calculation by:	JS	**Date:**	21/01/2013
Checked by:		**Date:**	

Catchment Characteristics	
Region	Scotland: South West Area
Area	(89) Awe and Etive
Boundary source	Imported polygon
Catchment Area (km²)	31.43
Other	Lake-area (km²)
Grid-resolution used for derivation of catchment characteristics (m)	11.08
Runoff (mm)	0
BFI	50

Ungauged Low-Flow Estimates

Period	Natural Qmean (m³/s)	Natural Q95 (m³/s)
Annual	1.941	0.418
Jan	3.062	0.487
Feb	2.528	0.463
Mar	2.556	0.503
Apr	1.297	0.445
May	0.892	0.394
Jun	0.948	0.383
Jul	1.030	0.382
Aug	1.308	0.397
Sep	2.081	0.414
Oct	2.476	0.481
Nov	2.531	0.534
Dec	2.607	0.469



Appendix D

SEPA Correspondence

From: Pattullo, Simon [mailto:simon.pattullo@SEPA.org.uk]
Sent: 24 June 2013 11:04
To: Neil Gordon
Subject: RE: Dalavich and Turnalt Hydro Scheme

Neil:

Dalavich
Provided the electricity generated would exceed 0.35Gwh per year and the impacted reach was less than 500m this proposal would be provisionally acceptable, provided all appropriate mitigation were included.

I hope this is clear but, as always, please get in touch should you need to discuss this further.

Regards,

Simon

From: Pattullo, Simon [mailto:simon.pattullo@SEPA.org.uk]
Sent: 21 June 2013 17:27
To: Neil Gordon
Subject: RE: Dalavich Hydro Scheme

Neil,

Thank you for forwarding this.

Regarding the Dalavich scheme, your interpretation appears correct – provided it would not cause a deterioration in status and produced greater than 0.35GWh per year then this could be provisionally acceptable. I will have to carry out an assessment to confirm this, and will do so early next week.

I apologise that this reply doesn't provide you with concrete answers but I will be in touch soon to discuss.

Regards,

Simon

From: Neil Gordon [mailto:NGordon@envirocentre.co.uk]
Sent: 21 June 2013 17:15
To: Pattullo, Simon
Subject: Dalavich Hydro Scheme

Simon,

Thank you for your time on the phone earlier this afternoon regarding the above scheme and SEPA's hydropower checklist. As discussed, reducing abstraction to meet High Standards means the scheme is unlikely to produce 0.35 GWh per year so is provisionally unacceptable. Running the schemes through the checklist on page 7 of the *Guidance for developers of run-of-river hydropower schemes*, however, suggests there may be a way forward for the scheme as indicated below:

- Dalavich – potential generation ~1 GWh/yr, equivalent to a 250+kW scheme. The depleted reach would be less than 500m, however, so would not cause a deterioration in status. The scheme may therefore be acceptable to SEPA.

I would be grateful if you could confirm my understanding is correct or, if not, if you could advise on what further steps could be taken for these potential schemes?

Any further advice you could provide would be much appreciated.

Regards,

Neil

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