Merkland Burn Micro-Hydro - Species Protection Plan for the Killarney Fern

Date: 21/04/2023

Introduction

The Killarney Fern (KF) is a European Protected Species (EPS) which inhabits mild, shaded and humid habitats. It has historically been identified as inhabiting the Merkland Burn. In 2022 a Bryophyte survey was conducted along the proposed depleted reach of the Merkland Burn hydro by [redacted] (Bryologist) with the intention of identifying target and scheduled bryophytes, as well as identifying the range and location of the KF's presence.

Figure 1 - Killarney Fern Site [Des Callaghan 2022]

Figure 2 - Killarney Fern [Des Callaghan 2022]

This document has been prepared using information from the 2022 bryophyte and KF survey, as well as the 2022 extended phase 1 habitat survey [Naturally Wild] and a site visit conducted on the 20th of April 2023 by the developer to assess the KF site and how changes in flows may impact the KF's habitat.

The 2023 site visit was conducted during a period of very low flows. SEPA's rain gauge on the Isle of Arran is not functioning at the time this report was produced. However, the nearby Dippen and Prestwick rain gauges recorded the last significant rainfall on the 12th of April.

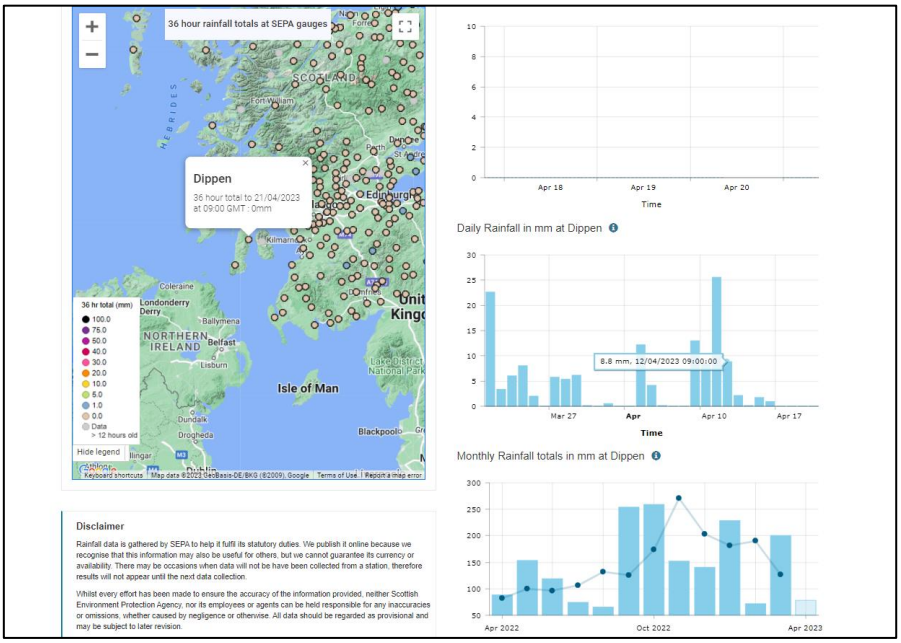

Figure 3 - Dippen Rainfall April 2023

The photographs and flow recordings included in this report are therefore representative of flows which are lower than the minimum flow at which the turbine can operate under the minimum licensable compensation flow conditions.

Killarney Fern Habitat

The KF was found in a single location along the depleted reach at NS 01973 38858, approximately 500mm above the low water line on the underside of a large boulder, at the bottom of a ravine and which forms a small cave against the side of the ravine. A deep pool of water surrounds the boulder and extends directly beneath the fern's position on the boulder. This pool is retained by a few large boulders ~6m downriver from the entrance of the cave.

A small proportion of the river's flow enters the rear of the cave and passes underneath the fern and on the opposite wall of the cave (a few hundred mm away) water continuously drips down the rock face, across common bryophyte species.

The water which enters the rear of the cave enters from the base of a deep pool which has formed behind the boulder. The point at which water enters the cave from the pool is significantly lower than the outlet of the pool through which the majority of the burns water flows. Therefore, water preferentially flows into the cave even at the lowest water levels.

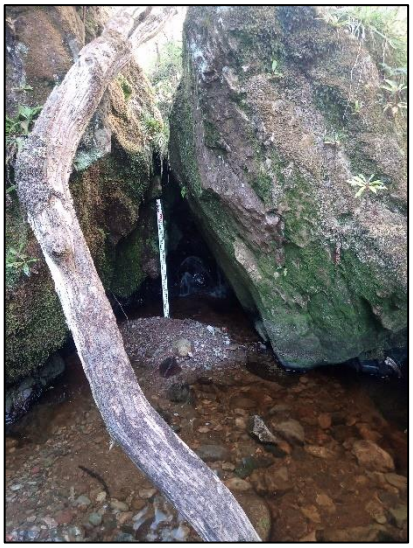

Figure 5 - Killarney Fern Cave [20/04/23]

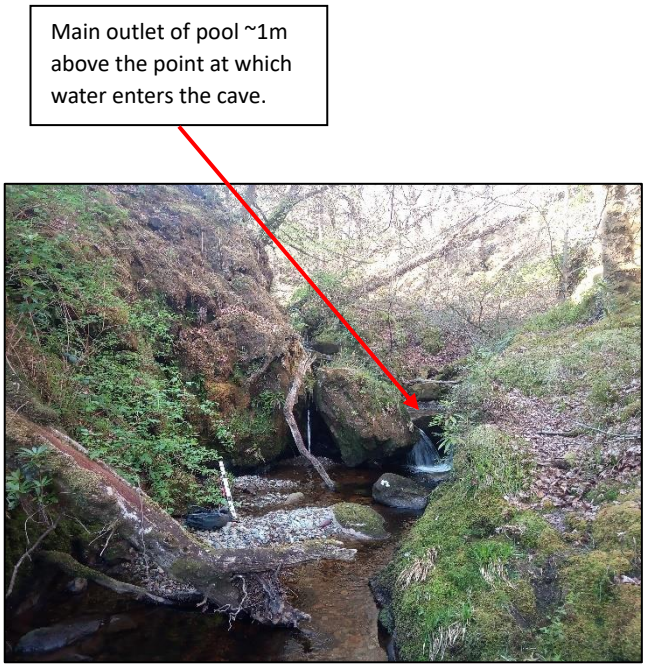

Figure 4 - Killarney Fern Site [20/04/23]

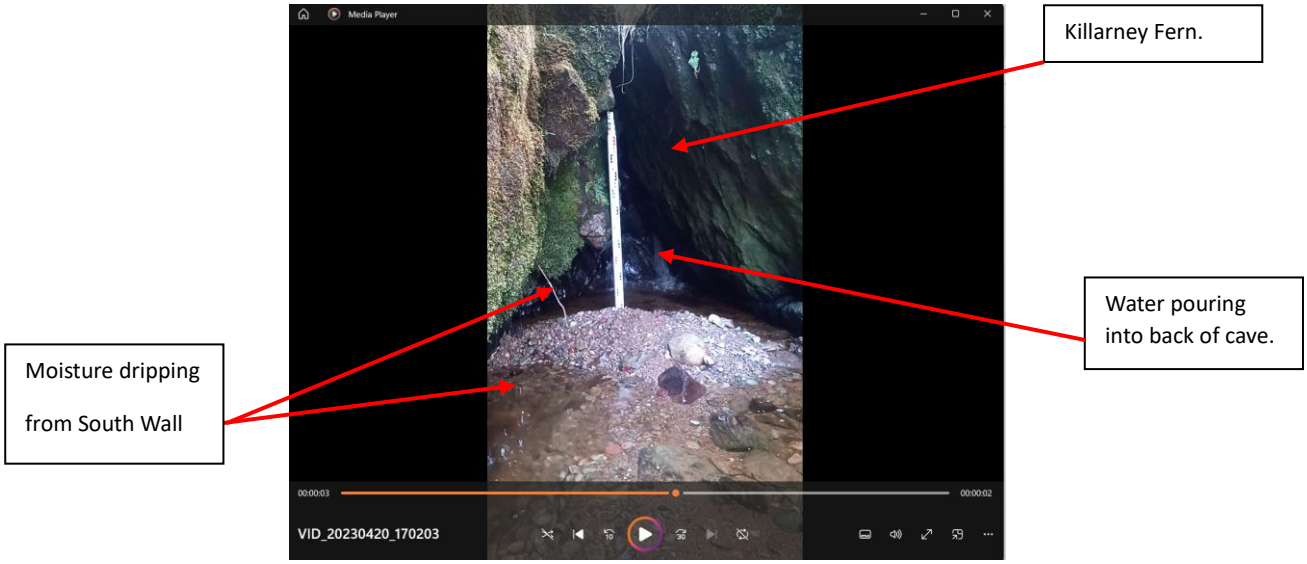

Figure 6 - Moisture in Killarney Fern Cave [20/04/23]

Figure 7 - View downriver from KF cave entrance.

Potential Impacts

Without diligent design and construction methodology, this development has the potential to impact the KF.

Direct Impacts

Direct impacts such as polluting the fern or its substrate, or physically damaging the fern or the immediate vicinity could have a very significant effect on the species population in this watercourse.

However, the fern's location offers good protection against unintended direct harm from construction activities.

No part of the construction site is within the water catchment area of the ferns substrate and the KF is located sufficiently high above the low to medium watermark that pollution which could feasibly arise through the accidental spillage of harmful substances into the Merkland Burn is unlikely to impact the fern. The scale and type of the construction works are exceptionally unlikely to cause sufficient pollution during a period of high flows, when the fern could potentially be inundated, to significantly degrade water quality.

The fern's location is well away from foot access routes, inconvenient to reach by foot, and impossible to reach with construction plant. Therefore, physical disturbance to the fern is exceptionally unlikely.

Figure 8 - Catchment area of KF site, penstock location in blue and distance between KF site and penstock.

Indirect Impacts

The KF is a species which inhabits cool, shaded and humid sections of watercourses. Inconsiderate abstraction of water from watercourses where the KF is present has the potential to reduce the suitable habit for the species.

The KF at Merkland Burn is located 1.1km downriver from the proposed hydro intake location. The catchment at the ferns location is 2.44km2, whereas at the proposed intake location the catchment is 1.67km2. The hydro abstraction will therefore only impact 68.4% of the flows which pass the cave that the KF inhabits.

Additionally, the abstraction licenses of modern hydro-schemes are designed to protect the high and low flow rates of the watercourse. It is not uncommon for a micro-hydro scheme to spend the driest three months of the year switched off due to low water. During these dry periods, the hydro has no effect on river flow rates.

The site was visited on the 20th of April 2023 to gather information to form this plan. Flow rates were measured using a natural v-notch and a natural rectangular notch located within 50m of the ferns location and calculated to be 11.1Ltr/s and 10.2Ltr/s (approximately Q96 based upon Lowflows FDC modelling) respectively.

Figure 9 - Natural V-notch ~50m up river of KF site.

Figure 10 - Width of V-notch

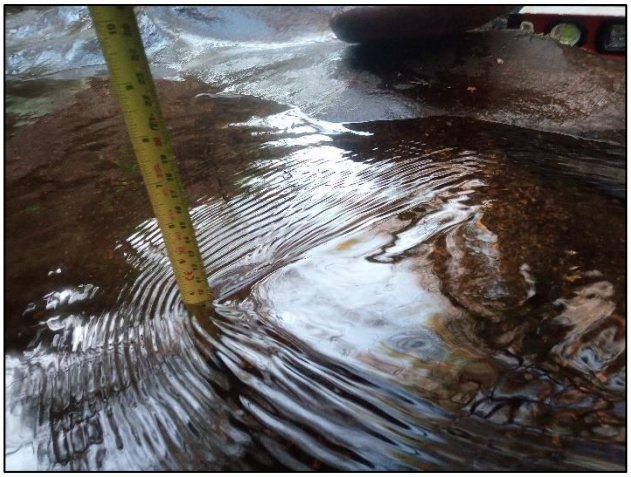

Figure 11 - Depth of water flowing over V-notch

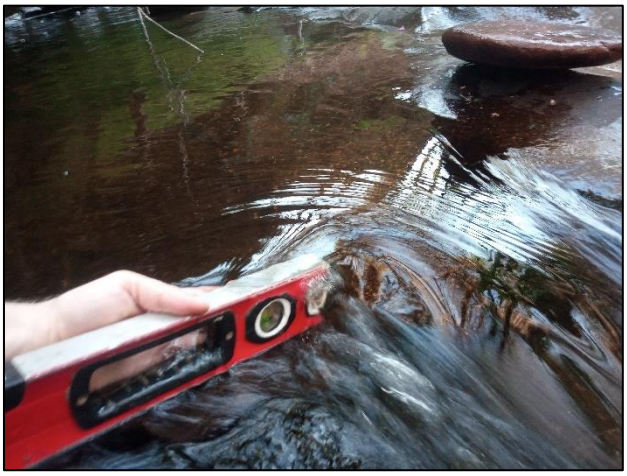

Figure 12 - Regular straight sides of V-notch as shown by straight edge

Table 1 - Conditions in natural V-notch on 20/04/23

Width	Depth	Flow Rate	Q-Value
500mm	95mm	11.1Ltr/s	~96

Figure 13 - Rectangular notch ~35m upriver of KF site

Figure 14 - Depth of rectangular notch, measurements taken every 100mm.

Table 2 - Conditions in natural rectangular notch on 20/04/23

Width	Depth	Flow Rate	Q Value
400mm	70mm	10.2Ltr/s	~96

Typical compensation flow requirements for a micro-hydro of this size begin at Q90, rising to Q80 when flow above the intake is at Q30, but can be as low as Q95 rising to Q80 when the flow is above Q30, if accurate on-site flow data is available. We can therefore be confident that even under the most impactful possible license conditions, the damp walls of the cave will be maintained, as will the river flow into the cave and the pool which covers the cave floor.

It is therefore very unlikely that the hydro-abstraction will cause a considerable change in conditions in the cave which the fern inhabits.

Prevention, Enhancement and Protection

We propose a series of prevention, enhancement and protection measures are carried out during construction and once the scheme is commissioned in order to reduce the risk of harm to the KF to exceptionally low levels.

Direct Harm Prevention

- No construction activities are to take place within 50m of the KF's location, except when carrying out enhancement measures (see enhancement section).
- Good practice guidance followed with relation to the storage, transport and usage of harmful substances, as well as in river working conditions and trench dewatering.
- Construction workers showed the location of the fern and informed that protection of the fern is of the utmost importance.

Indirect Harm Prevention

- The maximum abstraction, hands-off-flow and residual flow conditions of the hydro scheme must be set in coordination with NatureScot and SEPA. These flows must be strictly adhered to.
- With the approval of SEPA, the hands-off-flow and residual flow will be supplied through a circular orifice which transfers water from inside the hydro's intake chamber, back into the watercourse. Rather than via a v-notch or rectangular notch built into the intake weir crest. A compensation orifice such as this cannot be blocked by debris being transported down the watercourse during high flows, as water passing through the orifice has already been screened by the intake's coanda screen.

awaiting photo of intake with circular orifice

Enhancement

The pool which covers the cave floor is maintained by several locally large boulders and a pile of small-medium stones approximately 6m downriver from the entrance of the cave.

During low flow conditions (<~Q80), all of the river flow passes through a 400mm x 200mm natural rectangular notch to one side of the watercourse which has formed between a boulder and the bedrock river bank.

The long-term stability of these boulders and sediment pile is not guaranteed and their removal during a large spate could occur in the future. This has the potential to lower the level of the pool during low flow conditions considerably, regardless of any impact the hydro development could have.

The position and height of these boulders can be maintained over the long term by casting a small amount of concrete to fix them in place. This can be done in a manner which maintains the size of the natural notch that regulates low water levels, while not impacting the level of the pool during medium to high flows.

Figure 15 - View downriver from KF cave. Blue line indicating potential wall to maintain KF cave pool

Protection

There is a considerable growth of Rhododendron Ponticum (RP) in the immediate vicinity of the KF site, as well as a large number of self-seeded Sitka Spruce (SS) saplings which have been seeded from the commercial plantation, which was recently felled, the edge of which was ~30m from the KF site.

Whether or not the plantation will be replanted is yet unknown, however, if not removed the SS trees will eventually create very significant shading of the KF site which would be a detriment to the KF as well as the mature native woodland that surrounds it.

We propose that the developer commits to keeping a 50m buffer around the KF site clear of RP and SS growth for the life of the hydro-scheme.

Figure 16 - Rhododendron and Sitka Spruce on South bank of KF side.

Figure 17 - Rhododendron and Sitka Spruce on South bank of KF side.

Figure 18 - Rhododendron and Sitka Spruce on North bank of KF side.