Case-study based analysis of the success of good practice and mitigation of landscape impacts of tracks in the Scottish uplands.

A report for Scottish Natural Heritage.

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Summary

Access tracks that are poorly constructed have the potential to detract from the cultural and economic value of Scotland's landscapes. Scottish Natural Heritage (SNH) are tasked with protecting these landscapes by promoting best practice via guidance and consulting on potential impacts arising from new developments.

This report aims to assess the success of landscape impact mitigation resulting from hydroelectric scheme access tracks in Scotland's upland areas. This is achieved through a review of construction documentation and ground-truthing of hydro scheme case studies located in Loch Lomond and the Trossachs National Park. It continues by investigating current industry opinion on poor and good practice in addition to how SNH guidance is received by the industry.

Case study hydro schemes demonstrated varying success with respect to reinstatement. Commonalities of best practice include re-establishment of vegetation along track edges and creation of a vegetated central strip. Detrimental practice has led to erosion of slopes and track design that conflicts with surrounding landform. The scale of these practices varied between sites.

Interviews with Landscape Clerks of Works identified potential reasons for both poor and best practice during track construction and provided insight on the relevance of SNH guidance. Continued communication amongst all key stakeholders is vital in aiding best practice. Collaboration among these stakeholders also has the potential to improve future guidance and increase both guidance awareness, in addition to best practice uptake.

Disclaimer

This report was submitted in fulfilment of the author's postgraduate studies at the University of Strathclyde. The views and opinions expressed within are those of the author at the time of writing and do not necessarily reflect those of the University of Strathclyde. The author takes no responsibility for the continued accuracy of this report or for its use by another party. Note that at the time of writing, case studies appraised in the report had been recently completed and were still undergoing restoration and monitoring efforts by the planning authority.

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List of Abbreviations

EIA	Environmental Impact Assessment
ES	Environmental Statement
IEMA	Institute of Environmental Management and Assessment
LCoW	Landscape Clerk of Works
LLTNP	Loch Lomond and the Trossachs National Park
LLTNPA	Loch Lomond and the Trossachs National Park Authority
LVIA	Landscape and Visual Impact Assessment
QGIS	Quantum Geographic Information System
SNH	Scottish Natural Heritage
WLA	Wild Land Area

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[1] All site photographs supplied herein were taken by the author on the site visit date cited.

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1. Introduction

Owing to the remoteness and discreet nature of most hydroelectric scheme (hereafter "hydro scheme" or "scheme") components in the Scottish uplands, their associated access tracks are often the most obvious addition to the landscape (Beresford, 2014; Scottish Natural Heritage (SNH), 2015a). Such additions can detract from the landscape's character (SNH, 2015a), in addition to our enjoyment of and personal connection with the environment (Brown, 2015; Kolbovsky and Medovikova, 2017). Consequently, the proliferation of hydro access tracks in Scotland has become a contentious subject among lobbyists (Nicoll, 2018) and received recent parliamentary attention (Scottish Parliamentary Corporate Body, 2018: p. 17).

It is the remit of Scottish Natural Heritage (SNH) to support the sustainable use of Scotland's natural resource, whilst also protecting natural heritage (SNH, 2017a). This includes preserving the landscape[2] itself by promoting impact mitigation best practice. SNH (2015a) has therefore provided guidance in the form of the *Constructed tracks in the Scottish Uplands* document; an overview is provided in Box 1.

Box 1. Overview of SNH (2015a) guidance

SNH (2015a) guidance document: Constructed tracks in the Scottish Uplands

The *Constructed tracks in the Scottish Uplands* best practice guidance evolves over time based on the development of new information. It details how tracks can be better designed, constructed and restored to alleviate impacts on Scotland's biodiversity, geodiversity, its various environments (e.g. moorlands, hummocky landform, broad or narrow valleys, etc.) and use of these environments. In addition to explanatory text, the guidance employs a series of tools to communicate its main points, including photographs of unspoiled landscapes, plant and animal species, and tablised data, in addition to technical drawings of appropriate track design. In its current form, the guidance is 147 pages long and has been compiled based on the advice of consultees such as engineers (e.g. Munroconsult Ltd. and Arvikaconsult Ltd.), non-profits (e.g. The Mountaineering Council for Scotland), and local and national park authorities (e.g. Highland Council and Loch Lomond and the Trossachs National Park). The guidance is publicly available via SNH's website.

This report investigates mitigation of landscape impacts arising from hydro scheme tracks by reviewing scheme specific literature and ground-truthing of three case study access tracks[3]. Subsequently, interviews with Landscape Clerks of Works (LCoW) are used to provide expert opinion on best practice and current SNH (2015a) guidance.

[2] Landscape is defined as "an area, as perceived by people, whose character is the result of the action and interaction of natural and/or human factors" (Council of Europe, 2000 in The Landscape Institute and Institute of Environmental Impact Assessment (2013)).

[3] Case studies appraised in the report had been recently completed and are therefore still undergoing restoration and monitoring efforts by the planning authority.

Following an overview of the methodology, results are presented for case study hydro schemes and interviews. A subsequent discussion of poor and successful landscape mitigation is then followed with the presentation of best practice recommendations and opportunities for future adjustments to guidance. Supporting appendices are compiled at the end of the report.

2. Methodology

The approach described herein was adapted from Beresford's (2014) report for SNH on reinstatement of hydro schemes and wind farms. It involves three techniques: a desk study, site visits and interviews; the interaction of which is illustrated in Figure 1. Adoption of this approach resulted from discussions between SNH staff and the author.

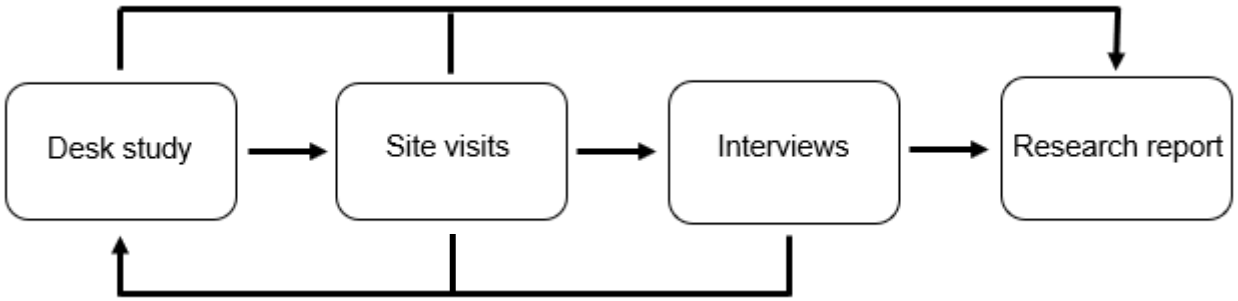

Figure 1. Methodology flow diagram

A review of relevant industry literature, including SNH's (2015a, 2015b) guidance on track construction and Landscape and Visual Impact Assessment (LVIA) guidelines (Landscape Institute and Institute of Environmental Impact Assessment (LI and IEMA), 2013), provided an introduction to landscape impacts and best practice. This was followed by a desk study of planning documentation (involving Environmental Statements (ES), their enclosed Construction Method Statements (CMS), planning conditions and Landscape Clerk of Works (LCoW) reports for selected case studies). Schemes were initially selected based on provision of documentation by SNH. Owing to developments either not proceeding passed planning or the unavailability of relevant documentation, it was necessary to instead review hydro schemes within the jurisdiction of the Loch Lomond and the Trossachs National Park Authority (LLTNPA). Site selection was also dictated by proximity to the author's base (within a reasonable travelling distance).[4]

Site visits to three schemes in Loch Lomond and the Trossachs National Park (LLTNP) followed to determine mitigation success. These sites were visited by the researcher and a research companion

[4] The author is based in Glasgow, Scotland with limited vehicle access. A reasonable travelling distance is considered a four hour return journey.

independently of SNH. Whilst on site, georeferenced photographs were taken using the Avenza Maps app[5] and subsequently mapped using Quantum Geographic Information System (QGIS) software.[6] A risk assessment was conducted prior to these visits and approved by the University of Strathclyde.

Finally, landscape professionals were interviewed to determine the influence of SNH (or equivalent) guidance on track design, construction and reinstatement, and to provide professional opinion on how the delivery of such guidance could be improved. Landscape Clerks of Works (LCoWs)[7] were identified by SNH or LLTNPA staff: four were invited to participate via email, with three providing both verbal and written consent to participate. Semi-structured interviews took place on separate days: at the participant's request, one interview was conducted in person at a public location close to the participant's place of work; the remaining two were by telephone. All interviews were audio recorded and detailed notes were taken throughout. Audio files were transcribed using the Sonix[8] transcription service and subsequently destroyed. Recurring themes across each interview transcript were identified using a colour-coded system and, where relevant, key points were then used to review desk study and site visit data. Prior to interviews commencing, ethical approval was granted by the University of Strathclyde.

3. Case study results

This section presents results from three hydro scheme case studies. Similar to Beresford (2014), a brief overview of each scheme based on planning documentation will be provided and followed by site visit observations. A full review of consulted literature is not provided as the purpose of this activity was to determine current status of case study tracks. Further details for each scheme, including locations of numbered viewpoints, are available in Appendix 1.

3.1 Gleann Casaig hydro scheme

Gleann Casaig hydro scheme is located in Loch Lomond and the Trossachs National Park, falling within the buffer of Wild Land Area[9] (WLA) 7: Ben More - Ben Ledi area (SNH, 2017b). The 1,520 (megawatt hour) MWh per annum development stems from Glen Finglas reservoir, around which there are numerous walking tracks, and into predominantly open upland (Dulas Ltd, 2014a: Ch 4., p. 30); as per Figure 2. Minimisation and mitigation of landscape impacts were cited as reasons for the appointment of a LCoW (planning condition

[5] Avenza Maps is a mapping service that uses smartphone location services, pre-loaded maps and on-site photographs. It is available at https://www.avenza.com/.
[6] Quantum Geographic Information System (QGIS) software is an open-source geospatial analysis tool.
[7] LCoWs are landscape experts employed by a developer to minimise landscape impacts by supervising construction and reinstatement throughout a development's construction phase.
[8] Sonix is an online transcription service available at https://sonix.ai/.
[9] Wild Land Areas (WLA) are non-statutory designations describing uninhabited and remote areas "where the influence of human activity on the character and quality of the environment has been minimal" (Scottish Government, 1999).

23) (LLTNPA, 2014: p. 7-9). Table 1 provides a summary of site visit conditions and an access track description. A list of on-site observations then follows.

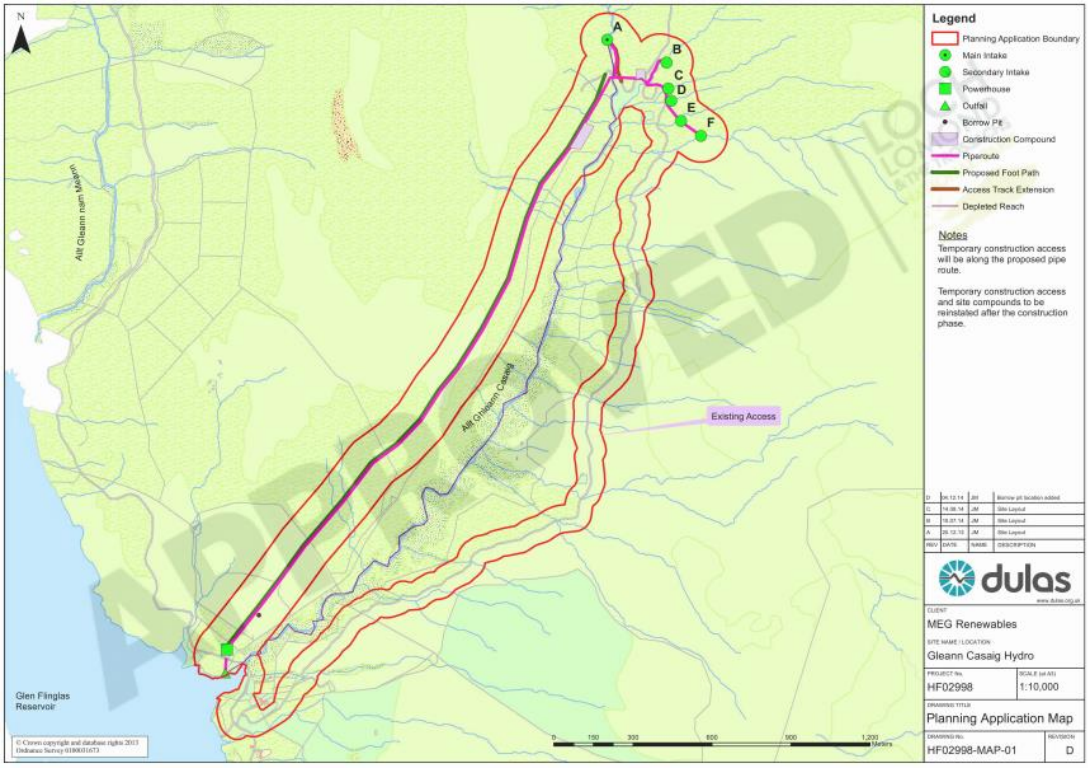

Figure 2. Gleann Casaig hydro scheme site plan (Dulas Ltd, 2014b)

Table 1. Summary of Gleann Casaig hydro scheme

Gleann Casaig hydro scheme		
Location	**Time/Date of site visit**	**Conditions during site visit**
Allt Ghleann Casaig, east of Glen Finglas Reservoir, Stirlingshire.	Morning 17th March 2019	Mostly clear, dry and no noticeable wind. Land predominantly covered in snow (estimated 0-5 inches) from recent snowfall.
Track description (based on desk study)	Access to the site comprises of an existing 2-2.5 m wide track on the eastern side of the stream, that would require minor improvements during construction. A permanent extension to this track of approximately 200 m would be completed to provide main intake access. An additional 2.7 km track would be required on the stream's western side to facilitate pipeline installation; this was to be reinstated to form a 2 m footpath and linked with the existing track to form a looped walking route (Dulas Ltd, 2014a: Ch 4., p. 38, p. 63).	

Site visit observations:

- The existing access track on the stream's eastern side was in a varied state. The central-strip turf was sparse and intermittent, and framing vegetation was mostly neat along the length of the track; areas where vegetation remained pocketed showed signs of trampling by livestock and it was assumed these were frequented for local farming purposes (viewpoints 1-5). At one point, a burn

overflowed onto a low lying point in the track, mixing with sediment and manure before continuing downhill.

- The track extension and looped track matched land contouring well (Figure 3), remaining inconspicuous from a distance. Slopes demonstrated signs of revegetation when snow was lifted at random (Figure 4), however, atypical steeply cut slopes where vegetation was sparse showed signs of erosion (Figures 5 and 6). Despite this, grassy stems above the snow line on the immediate edge of the track and along the central strip were evident (Figure 6).
- The intake itself was discreet and scarcely visible from the existing track (viewpoints 12 -14) and footpath (viewpoint 28).
- The new footpath accompanying the pipeline was high on the hill and predominantly linear against the undulating hillside. It was visible along the length of the existing track (Figure 7), becoming less noticeable nearing the track extension and intake.
- While heading towards the reservoir along the footpath, the easterly existing track was noticeable in places, however, it mostly matched landform and at times disappeared from view (either due to trees or landform) (viewpoints 28, 30 and 34-35). This may be condition dependent as snow softened the landscape.
- The footpath's width was noted as being large for a footpath (measuring tape was not to hand to confirm); two walkers could walk comfortably side-by-side, with room for two persons more at times. It resembled a vehicle access track (viewpoints 37-38 and 41).
- The footpath's batters were extremely steep at times, occasionally for long stretches, with sparse pockets of vegetation and signs of erosion (Figure 8). The exposed soil resulted in landscape scarring that was previously observed while walking along the existing track from the opposite side of the gully (viewpoints 8-9, 14, 25).
- Nearing the powerhouse, descent along the footpath was uneven and steep (viewpoints 40-41 and 44); once again, there was evidence of livestock activity. The path's surface became even, with neatly vegetated flanks once downhill and within close proximity of the powerhouse (viewpoints 45-46).
- Standing on the bank of the reservoir and adjacent to the powerhouse, the footpath and existing track were well shielded (viewpoint 46). However, based on views of the reservoir from uphill (viewpoints 6, 9, 39-42), it is assumed the footpath and/or existing track would have been partially visible from the far bank (this was not confirmed owing to time restraints and lack of public vehicle access to the reservoir).
- Areas of the tracks not under snow cover appeared dark grey in colour but due to snow, it was not possible to fully discern if this was complementary of the surrounding landscape. Consulting photographs on the Parkswatch Scotland website (Kempe, 2019), colour contrast appears to be seasonal; this is, however, unverified by the site visit.

Figure 3. Gleann Casaig: from the footpath facing northeast towards the loop track; viewpoint 27

Figure 4. Gleann Casaig: signs of revegetation of new track extension batters; viewpoint 17

Figure 5. Gleann Casaig: signs of poor revegetation and erosion of new track slopes; viewpoint 20

Figure 6. Gleann Casaig: signs of vegetation along the new track side and mid-verge; facing south; viewpoint 20

Figure 7. Gleann Casaig: from the existing track facing west towards the pipeline and accompanying footpath; viewpoint 8

Figure 8. Gleann Casaig: mixed signs of revegetation on steep footpath slopes; facing north, viewpoint 29

3.2 Glen Falloch hydro schemes

The Glen Falloch hydro schemes are all located within Loch Lomond and the Trossachs National Park. Ridged and expansive uplands are typical of the area, with woodlands dotted across hummocky lowlands (SNH & LLTNPA, 2010). The area hosts the A82 road between Inverness and Glasgow, a railway route and the West Highland Way (WHW) walking track. There are four hydro schemes in total: Allt Fionn, Ben Glas, Derrydarroch and Upper Falloch (Hydroplan UK, 2009a). The latter two have been reviewed for the purposes of this report and are considered below.

3.2.1 Derrydarroch hydro scheme

Derrydarroch is a 2 MW (megawatt) hydro scheme, with five intakes across tributaries to the River Falloch. The scheme spans either side of the A82 road and railway, with upland components encroaching on WLA, while the pipeline and lower track crosses the popular WHW lowland route (Craignish Design, 2009: Appendix J, pp. 1-2); as per Figure 9. Appointment of a LCoW was required (planning condition 10) for supervision of track design, construction and restoration (Energy Directorate, 2010a). Table 2 provides a summary of site visit conditions and an access track description; site observations follow this.

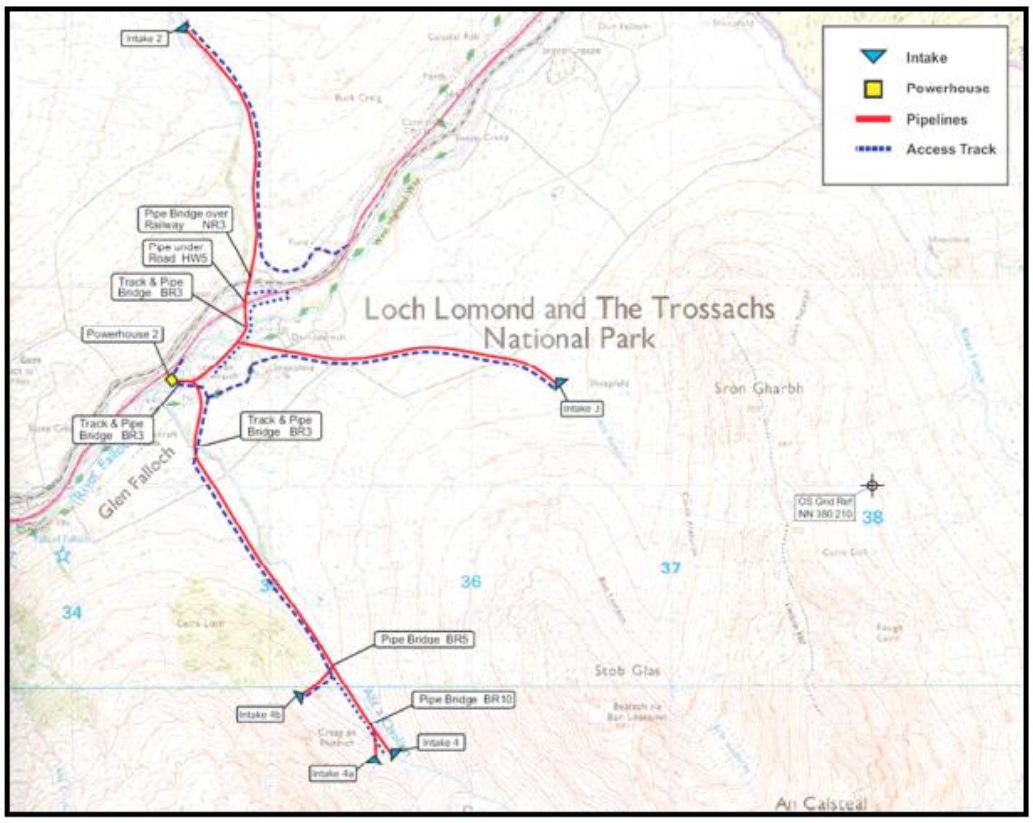

Figure 9. Derrydarroch hydro scheme site plan (Hydroplan UK, 2009a: p.2)

Table 2. Summary of Derrydarroch hydro scheme

Derrydarroch hydro scheme		
Location	**Time/Date of site visit**	**Conditions during site visit**
Glen Falloch Estate, southwest of Crianlarich, Stirlingshire	Mid afternoon 24th February 2019	Clear, dry and slight winds. Land cover clear and dry.
Track description (based on desk study)	Access to the site comprises of both existing and new tracks. The track to intake 4 heads southeast from the A82 road, intake 3's track heads northeast, while heading northwest is the track to intake 2. Some new tracks were initially intended to be temporary and/or restored to 'green' tracks following construction. However, 6km were subsequently made permanent for intake servicing and land management purposes. Tracks were to be no more than 5 m wide. Tracks to the east overlap with the existing WHW footpath (LLTNPA, 2013a).	

Site visit track observations:

- The central strip along intake 4's track was maturely vegetated with intermittent gaps (Figures 10 and 11); this was in stark contrast to lengths of the existing track (including a portion of the West Highland Way), which remained bare. The immediate edges were neat and well vegetated. However, there were points where soil was disturbed and exposed next to the drainage ditch, resulting in localised scarring and track widening (Figure 10).

- Heading towards intake 4, the track kept neatly to landform and disappeared from view (Figure 11). A passing place was shielded by trees and not visible until within close proximity; this led to considerable localised track widening and revegetation was sparse (Figure 12). (It was not checked if this was visible from hills in the southeast. Owing to time constraints, the full length of the track was not viewed.)
- Owing to time constraints, the intake 3 track extension was not viewed. The existing track had maturely vegetated edges and the central strip was wide despite there being numerous gaps (viewpoints 12-13).
- Predominantly owing to it's colour not matching surrounding vegetation, intake 2's track on the opposite side of the A82 was visible from the easterly tracks (continuously from the existing tracks and intermittently from intake 4's track) (Figures 10 and 13). The issue of colour was applicable to all tracks, however, eastern tracks matched existing tracks and successful revegetation dulled the contrast.
- Tracks to intakes 3 and 4 were visible from high up on intake 2's track (Figure 14). This was true of existing tracks, with extensions largely being hidden by landform and trees.
- Heading towards intake 2, track edges were predominantly neat and the central verge was well established and continuous (Figures 14 and 15). Therefore, at close range, this dulled the track's contrast with the surrounding landscape.
- Near the beginning of intake 2's track, batters were steeper to one side of the track (Figure 15). Vegetation was in pockets and signs of erosion were evident, resulting in localised landscape scarring and widening of the track's overall impact. This was uncharacteristic of the track.
- Tracks were collectively visible throughout the area. In addition, powerlines and pylons, the cottage and the A82 road (although mostly shielded by trees, the noise from traffic was always audible; it is unknown if frequency of traffic is more or less on weekdays) contributed to landscape encroachment (Figures 10 and 13).

Figure 10. Derrydarroch: exposed soil on intake 4's track. Facing northwest towards existing tracks with the track for intake 2 visible in the distance; viewpoint 4

Figure 11. Derrydarroch: central verge vegetating along intake 4's track. Facing southeast towards the intake, the track neatly keeps to landform; viewpoint 8

Figure 12. Derrydarroch: a passing place widens the track to intake 4; viewpoint 9

Figure 13. Derrydarroch: facing westerly, intake 2's track is visible from intake 3's existing track; viewpoint 12

Figure 14. Derrydarroch: from intake 2's track and facing southeast, existing and new tracks are visible for intakes 3 and 4; viewpoint 15

Figure 15. Derrydarroch: central verge well vegetated. To the right, the slope is visibly scarred and vegetation is pocketed; viewpoint 23

3.2.2 Upper Falloch hydro scheme

Upper Falloch is a single intake hydro scheme of 1 MW (megawatt) capacity (Hydroplan UK, 2009b: Ch 3., pp. 1-3). The scheme spans from the A82 road and railway line into upland, this area was particularly popular with walkers at the time of the site visit; Figure 16 shows the site's layout. Appointment of a LCoW was required (planning condition 10) for supervision of track design, construction and restoration (Energy Directorate, 2010b). Table 3 provides a track description and a summary of site visit conditions; site visit observations follow.

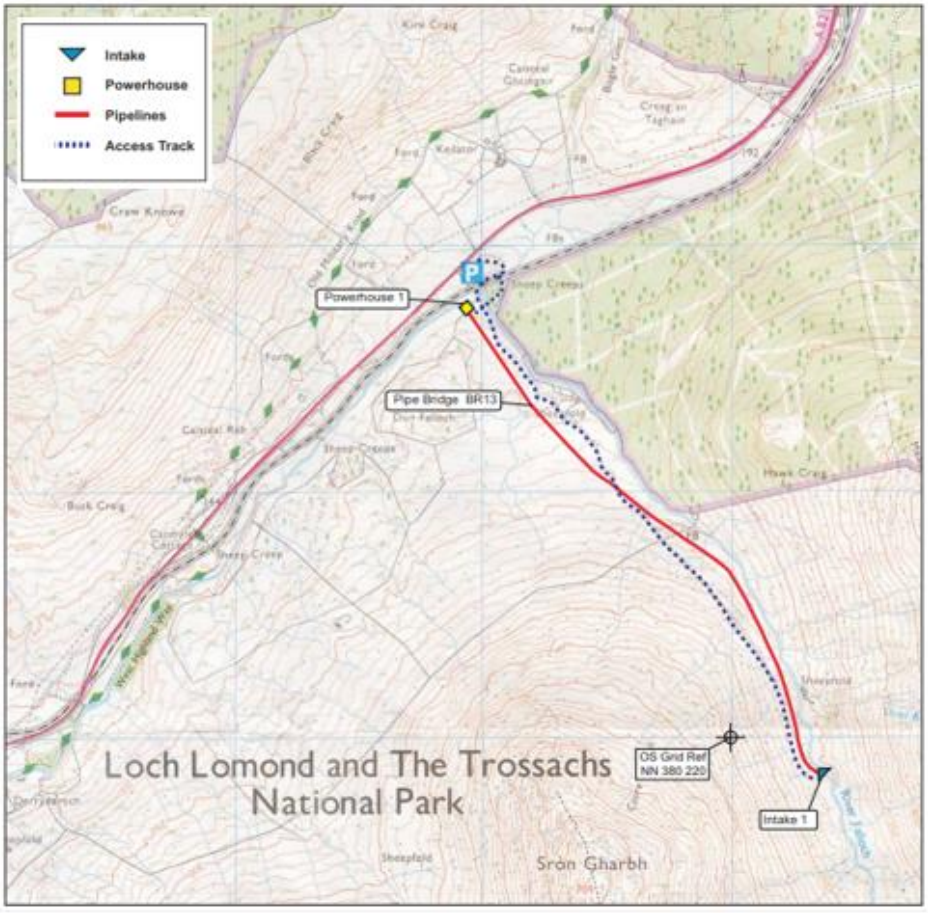

Figure 16. Upper Falloch hydro scheme site plan (Hydroplan UK, 2009b: Appendix L, p. 3)

Table 3. Summary of Upper Falloch hydro scheme

Upper Falloch hydro scheme		
Location	**Time/Date of site visit**	**Conditions during site visit**
Glen Falloch Estate, southwest of Crianlarich, Stirlingshire	Mid-late afternoon 24th February 2019	Clear, dry and slight winds. Land cover clear and dry.
Track description (based on desk study)	Access to the site originally comprised of a 500 m extension to an existing 2.1 km long track heading southeast from the A82 road. The existing track lies within a Wild Land buffer area. An additional 800 m track was subsequently added for intake servicing and land management purposes. Track width was to be 2.5m wide (LLTNPA, 2013b).	

Site visit track observations:

- The lower extension joined the existing track behind the railway line. It was shielded by trees by the railway and on the opposite side but remained visible from the lower end of the existing track; it was, however, in keeping with track character (Figure 17).
- Immediately east of the railway line, the track had sparsely revegetated and therefore locally widened (Figure 18). Localised widening was also occurring where pooled water had runoff and noticeably spilled gravel across the verge.
- This particular section of the new track had a central vegetation strip developing albeit intermittently. It was fenced off from the existing track and railway line (Figures 17 and 18). Walkers were not observed to be using the track, opting instead to use the pathway under the railway line. The looped track immediately next to the tree line was non-existent. (A locked gate by the railway restricted vehicle access. Due to time restraints, the upper track extension near the intake was unable to be viewed.)
- Construction materials and debris were left beside the track on either side of the railway line (Figure 19). It is unknown if these were related to the hydro scheme, railway, or other works. Again, these were shielded from the railway line by trees and from the road and carpark by landform. Although possible, it is assumed walkers are unlikely to use this section of the track given it is further away from parking facilities than the railway underpass.
- As the track loops round the borrow pit to the carpark, verges were predominantly neat with only some disturbance from tyre tracks; despite this, vegetation was observed to be re-establishing (viewpoints 9 and 10). Early development of a central strip was evident at points along this section (Figure 20). The borrow pit itself now resembles hummocks and is well vegetated (viewpoint 10 and 11).

Figure 17. Upper Falloch: view of the track extension; facing northeast from the existing track; viewpoint 1

Figure 18. Upper Falloch: facing southwest, shows sparsely revegetating. In the middle distance, water pooling is evident, resulting in gravel bleeding into the far verge due to runoff; viewpoint 6

Figure 19. Upper Falloch: view from the northern side of the railway line. It is unknown if debris is related to hydro scheme, rail works or other; viewpoint 8

Figure 20. Upper Falloch: perpendicular to the A82, track verges are neat and central vegetation is evident. Former borrow pit on the right has vegetated well and resembles hummocks; viewpoint 10

3.3 Key themes

In summary, the impacts of tracks across all case study hydro schemes were varied with evidence of both poor and good reinstatement. The tracks at both Derrydarroch and Upper Falloch sites were neatly framed, well shielded and vegetation was generally well established; this was also true of existing tracks and extensions at Gleann Casaig. Some ground disruption and steeper slopes had typically resulted in localised scarring and soil erosion, however, this was uncharacteristic of the Glen Falloch sites. Such issues were also

evident at Gleann Casaig along the existing track and extension, while widespread scarring along the footpath occurred on a larger scale. For the most part, tracks across all schemes matched landform well. However, the footpath at Gleann Casaig was the outlier on this point also, owing to it being oversized and linear. In addition, fragmentation of the wider landscape in Glenn Falloch was noticeable owing to track colour and immature trees failing to shield intake 2's track at Derrydarroch; however, landscape features unrelated to both schemes (such as the public road and powerlines) also contributed to this.

4. Interview results

Results from interviews with three landscape professionals will be presented herein. Each participant was male, of a professional working age, UK based, had a minimum of ten years industry experience, were adept in EIA and had assumed the role of Landscape Clerk of Works (LCoW) for hydro scheme developments throughout Scotland. During interview preambles, all participants voiced an awareness of track contentiousness in relation to renewable energy developments, with one participant citing those associated with hydro schemes as particularly controversial in Scotland. Recurring key themes and points[10] were subsequently identified via a colour-coded transcript analysis and are summarised below. Detailed results are presented in Appendix 2, with interview questions and notes in Appendix 3.

4.1 Reasons for potential neglect of landscape impact mitigation

While acknowledging various reasons why landscape impacts might not be appropriately addressed during scheme development, all participants cited time and financial pressures as central drivers for both developer and contractor. This was inevitably linked with issues of poor planning by all parties, or, by the contractor's values (those of the chief contractor in particular) and how these might differ from principles held by other stakeholders such as the planning authority or SNH. Indeed, one participant likened landscape impact mitigation as a development addendum, stating that it is often interpreted as non-functional work. This was further emphasised during discussions of consequences arising from poor landscape mitigation, with the majority of participants citing an inability to integrate into guidance literature or inadequate consideration by the planning system. However, opinion diverged on this point with one participant claiming a contractor's reputation would be scarred to the detriment of financial profit: "the ironic thing is that the difficulties they caused come back to bite them because not only do they not get future work but also because they had to redo a lot of the stuff they'd done badly the first time… they made a fairly substantial loss on these projects" (Participant A).

[10] Points were considered "key" when raised by two or more participants.

4.2 Reasons for landscape impact mitigation working well

Successful and/or satisfactory mitigation of landscape impacts stemmed from a central theme of communication. All participants agreed clear and continuing communication between all parties, especially between the LCoW and contractors, was vital to balancing expectations and feasible development outcomes. Participants noted contractors are typically highly skilled and are, therefore, in a position to help shape solutions if kept informed of expectations. However, it is essential to have such discussions early and at key moments throughout a development's lifetime in order to, according to one participant, overcome any scheduling changes and/or the speed at which construction can occur.

Moreover, each participant demonstrated an openness to collaborative learning and mutual exchange of ideas, with key stakeholder engagement deemed necessary in achieving successful landscape mitigation, especially for complex designs. While an increase in the number of site visits by planning authorities or SNH were not deemed crucial, one participant cited early interaction with stakeholders as useful for initial planning and development design, while another was of the opinion more feedback should be presented in response to LCoW site reports. All three participants stated they were rarely employed to monitor sites following their completion and therefore unaware if there were any restoration issues.

4.3 Role and influence of the LCoW

While not wholly essential to this research, it was necessary to better understand the LCoW's role and how it might influence impact mitigation. These were integrated throughout other key points represented herein, with the need for clear communication to/from the LCoW and careful balancing of stakeholder priorities outweighing the length of time spent on site. With one participant commenting that an LCoW's involvement was "light" (Participant B), two participants alluded to having little control over aspects of the development, owing either to being employed by the developer or not participating in the EIA process; the outlying participant was often also involved at EIA stage.

4.4 SNH guidance and consultary advice

Participants were firstly asked how SNH (2015a) *Constructed tracks in the Scottish Uplands* guidance and consultary landscape advice had proved useful during hydro scheme development. With respect to the latter, general consensus was that advice was well received by the developer owing to SNH's expertise with landscape impacts across multiple developments. Meanwhile, two participants conceded it could motivate contractors to deliver respectable results when used as "leverage… (to) do a good job here or SNH will be unhappy and we will not get consent for the next scheme" (Participant A). Moreover, another participant invited SNH to adopt a bolder position by explicitly requesting the enforcement of conditions during planning consultations.

Commenting on the length of SNH guidance, however, two participants were of the general opinion it discouraged a wide readership among developers and contractors. Indeed, when asked how guidance might be improved, all participants advocated for user-friendly literature that was condensed and more practically focussed. An increased use of visual aids and best practice case studies dominated each interview on this point, with participants identifying photographs as valuable tools that can provide clear instructions to contractors without causing too much disruption to site activities. One participant went further, suggesting SNH and/or planning authorities also request photographic evidence of previous work from developers and contractors to help ensure scheme construction does not go ahead without knowing if they are fully capable of successfully restoring the landscape.

Participants demonstrated varied awareness of SNH's (2018b) dangle book guidance on tracks.[11] One participant was enthusiastic about its practicality, advising its size and simplicity could facilitate effective instruction whilst on site. However, the same participant had yet to review the book's content, while another participant disagreed with some of the conclusions drawn with respect to poor/best practice.

5. Discussion

A discussion of the results is provided below. SNH (2015a) guidance and a best practice case study are also considered. Finally, research limitations will follow.

5.1 Discussion of results

All case studies examined herein demonstrated varying degrees of successful landscape impact mitigation efforts. All schemes made use of existing track access, tracks matched surrounding landform, while vegetation was evident along track edges and some central strips, thus softening the overall impact of the tracks (SNH, 2015a). The footpath at Gleann Casaig, however, was visible throughout the glen and matched the linear pipeline. This is contrary to best practice guidance (SNH, 2015a), which advises tracks should be located lower downhill and not conflict with natural landforms, despite this perhaps incurring more time, cost and effort to construct. These were, however, identified in point 4.1 as key pressures for contractors that might result in mitigation efforts being neglected. Furthermore, conforming to the guidance may not always be achievable owing to requirements of the intended track. With regards to Gleann Casaig, the footpath originally facilitated installation access to the pipeline which sits lower along the hillside. Furthermore, as per point 4.3, the potential for an LCoW to guide successful matching to landform is limited and could therefore benefit from LCoW input at an earlier stage in development.

[11] The dangle book (SNH, 2018b) is a relatively new guidebook. It is a series of postcards hooked together with pictures clearly marked as demonstrating good or bad practice; citing the consequences of the latter. As the author understands it, the book has been distributed at industry events and among some planning authorities.

Soil erosion and resultant landscape scarring along steep track edges was a common downfall of all schemes; although the scale did vary, with scarring along the footpath at Gleann Casaig being the most extensive. Avoidance of cutting steep slopes altogether is preferred, however, SNH guidance (2015a) warns that careful revegetation of such slopes is necessary to avoid long term scarring, citing limiting storage time for removed turfs and their continuous reinstatement throughout the construction phase as proactively decreasing the likelihood of slope erosion and scarring. These practices were evidenced in the LCoW reports for both of the Glenn Falloch schemes (Mike Hyatt Landscape Architects, 2014, 2015), where scarring was localised, but less clear in those for Gleann Casaig (Green Cat Renewables, 2016). However, scarring continues to be an issue where vegetation either fails to re-establish or slips (Harding, 2010). It would be beneficial to roughen slopes where vegetation re-establishment is found to be failing due to steep gradients. Indeed, Harding (2010) found disturbing smooth or compacted surfaces before seeding proved successful.

Furthermore, as per point 4.2, all interview participants advised LCoWs are rarely employed to monitor restoration success following scheme completion. Having a LCoW revisit site would allow for any neglected or failed mitigation attempts to be promptly addressed (Marshall, 2012). This could be particularly useful in raising levels of understanding and importance of landscape mitigation among developers (according to one participant, it is currently deemed non-essential to hydro scheme success).

Despite locally won material being used for each track (in-keeping with the best practice Coulags hydro case study (SNH, 2018) described in Box 2), landscape fragmentation occurred at the Derrydarroch scheme owing in part to track colour (Sidle and Ziegler, 2012).[12] However, this could be due to variation in rock type between upland and lowland areas (Gabler *et al.*, 2008), and a matter that could vary seasonally (LI & IEMA, 2013).

[12] Cumulative impacts arising from other landscape features also contributed to this. Owing to research constraints, cumulative impacts are not considered further in this report.

Box 2. SNH exemplar of best practice: Coulags run-of-river hydroelectric scheme

An example of best practice: Coulags run-of-river hydroelectric scheme

Having also received commendation from lobbyist group Parkswatch Scotland (Digney, 2018), the 1,500 kW hydro scheme located on Fionn Abhainn near Coulags in the Highlands is considered an example of best practice with respect to impact mitigation (SNH, 2018a).

Construction involved creation of a new access track in addition to the use of existing foot paths. Final track design was deemed to impose minimal impact on the surrounding landscape and provide the opportunity to upgrade existing foot paths with locally won material (Eden Environment Ltd., 2015: pp. 18, 20-21;43-44). The CMS is highly detailed with respect to the access tracks and paths (Green Highland Renewables Ltd. (GHR), 2015: pp. 15-18; pp. 21-24.), with supervision of both construction and restoration phases by an appointed landscaping contractor made clear (GHR), 2015: p. 5).

SNH (2018a) identified the following key points as contributing to the scheme's success:

- Early engagement: the developer sought SNH's counsel prior to submission of the development's planning application. This facilitated exchange of information and concerns between both parties, including those pertaining to landscape character and the sensitivities of relevant National Scenic Areas and Wild Land Areas.
- Partnership: joint site visits between the developer and SNH allowed for both parties to become familiar with the site prior to construction, and also for discussions of individual priorities and issues; thus, offering multiple opportunities to jointly address these prior to finalising the design.
- Adaptability and expertise: design alterations were made to better suit the surrounding landscape, as evidenced by the detailed CMS (GHR, 2015); thus, ensuring contractors were conscious of development expectations prior to tender. In addition, contractors also demonstrated adaptability and innovation with their tactics during construction.
- Continuing engagement and evaluation: site visits continued throughout scheme construction, thus allowing for expectations to be reiterated, any issues to be addressed and providing the opportunity for solutions to be mutually agreed.

SNH's (2018a) review of the Coulags hydro scheme identified key points of best practice; these included early engagement, partnership, adaptability and expertise, and ongoing engagement and evaluation. As per point 4.2, participants also emphasised the importance of communication among all stakeholders in delivering successful landscape mitigation. For example, early interaction between developer, planning authority and statutory consultees provides the opportunity to shape track design. Landscape expectations could therefore be thoroughly integrated into a scheme's CMS and subsequently better understood by the contractor. Indeed, landscape supervision was detailed in Coulags' CMS (GHR, 2015), while LCoW appointment on this report's case studies was later dictated by the planning authority (Energy Directorate, 2010a, 2010b; LLTNPA, 2014). Likewise, addressing construction or restoration issues as they occur delivers opportunities to both reiterate landscape expectations and stimulate discussion between all stakeholders (SNH, 2018a). As was noted by SNH (2018a), it can also promote contractor involvement in such discussions, which should be desirable as interview participants commented on contractor skilfulness and abilities in providing creative yet feasible solutions to problems.

The significance of communication among hydro scheme stakeholders became increasingly evident when participants were asked to comment on current SNH (2015a) guidance. General opinion was that, in its current form, it was inappropriate for a contractor or developer readership owing to its length and predominant focus on landscape character rather than the practicalities of construction. However, as per point 4.4, the majority of participants believed the guidance was also a useful tool that could stimulate better workmanship. In its current form, the document is therefore best used as a supplementary resource.

The provision of more visual aids (photographs, drawings, etc.) and best practice case studies were consistently identified by participants as possible improvements to current SNH (2015a) guidance. This is in keeping with SNH (2018b) dangle book content. The physical characteristics (size and design) of the dangle book promote on site referral and participants also voiced the need for condensed guidance that could be easily used by contractors whilst working on site. As previously mentioned, communication has proved instrumental in achieving successful landscape mitigation (Beresford, 2014; SNH, 2018a) and, while other parties have contributed advice to the current guidance, it would be advantageous to increase their involvement (and include those such as LCoWs and contractors) when developing future guidance. This could improve awareness of and adherence to guidance among contractors, while also producing content that all parties agree with.

5.2 Research limitations

The time frame for delivery of this report limited case study numbers. These hydro schemes could only be visited during the winter months of January – March 2019. As such, results presented herein are not representative of year-round conditions. Indeed, Gleann Casaig's visit was conducted during snow cover which resulted in softening of the landscape and a reduction in the author's ability to perceive landscape impacts related to the tracks.

Similarly, potential participant numbers were limited to four LCoWs; three of which agreed to participate. Participant identification was restricted to industry recommendations to help facilitate introductions and is, therefore, not truly representative of expert opinion throughout a wider pool of LCoWs. Likewise, while LCoWs were selected for interview based on their role requiring expertise and practical supervision of landscape mitigation, opinions from other industry professionals were not sought. Therefore, results only reflect the opinions of the interviewed participants.

Technical restrictions include the failure of audio recording equipment during one interview. Detailed notes were written to compensate. Similarly, differences in environmental noise during interviews led to quality variation of audio recordings. To overcome this, each transcript was subsequently reviewed and updated with the correct content; transcripts were also edited to protect participant anonymity and confidentiality.

Finally, georeferenced locations of photographic data are subject to possible error (Global Positioning System, 2019); mapped locations were deemed sufficient for analysis.

6. Recommendations

Points 5.1 and 5.2 demonstrate that there are opportunities to adjust current landscape impact mitigation practice and SNH guidance on track construction. These opportunities are explored below, followed by further research recommendations.

6.1 Opportunities

While it is recognised successful construction techniques are site specific, the case studies presented herein demonstrated landscape impacts could be mitigated reasonably well with revegetation of track edges throughout the course of construction, in addition to the establishment of a central vegetated strip. Likewise, case study tracks were less conspicuous when consistent with surrounding landform. Such practices are currently championed by SNH (2015a) guidance and it is recommended that this is continued in future publications. Furthermore, it would be beneficial if SNH used its position as an EIA statutory consultee to request developers employ an LCoW to revisit schemes during the restoration period. This would allow for identification of failing mitigation methods and timely rectification.

There is value in proactively maintaining regular contact with key hydro scheme stakeholders (such as the contractor, developer and LCoW) throughout a scheme's lifetime (including planning, construction and monitoring phases). Communication has proved essential in achieving best practice (SNH, 2018a), and regular discussion provides a platform for addressing arising issues, sharing ideas and reiteration of landscape expectations. Understanding of possible resource limitations, this research has shown that additional site visits are not necessary; indeed, contact could be primarily maintained via telephone.

Participating LCoWs have verified that the format (size, length and protective cover) of SNH's (2018b) dangle book is preferable to current track guidance which is too dependent on high-level text. As a portable reference guide for both LCoWs and contractors, the dangle book simplifies on-site consultation and explanation. Its reliance on visual aids for communicating poor and good practice also reflects the desires of participating LCoWs. It is recommended that future publications continue to match these specifications and increase the use of detailed case studies (inclusive of reasons why the result was poor or good).

However, it is understood the dangle book content has not been fully verified by external parties (based on participating LCoW comments). Participants advocated for practically focussed guidance that would be directly applicable to contractors, therefore development of guidance with increased involvement from other stakeholders would benefit guidance users. It is recommended SNH consult with LCoWs and contractors that

have proven their ability to successfully mitigate landscape impacts arising from access tracks in order to determine appropriate advice content. Building on the recommendations of Beresford (2014), this provides the opportunity for future guidance to be both more pragmatic and ambitious. Moreover, industry response to such guidance would help identify developers and/or contractors that were unwilling or incapable of achieving successful mitigation.

6.2 Further research opportunities

Further study options might include:

- reviewing more hydro scheme case studies to determine if results are consistent across the board
- consultation with more participants to establish if results are representative of a larger industry audience
- consideration of cumulative landscape impacts arising from hydro scheme access tracks
- a more technically focussed study of successful mitigation methods
- consideration of hydro schemes with and without LCoWs appointed to better determine LCoW influence on successful mitigation.

7. Conclusion

This report has assessed the success of landscape impact mitigation arising from Scottish hydro scheme access tracks. The scope was twofold, firstly aiming to determine good practice with the use of three case studies and, secondly, to determine how SNH might revise track guidance in order to promote better practice. Each scheme demonstrated both successful mitigation attempts (points of commonality included turf re-establishment and conforming to landform) and failed (poor re-vegetation leading to erosion and scarring), with scale being the main variance. Subsequently, consultation with Landscape Clerks of Works facilitated an understanding of how current SNH guidance is perceived within the industry (too long and not targeted at a contractor readership). There is a need to improve communication across scheme stakeholders and, in collaboration with stakeholders, produce landscape guidance that is visually stimulating, in addition to being both practical and aspirational in achieving best practice.

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Appendices

Appendix 1. Case study data

Herein is further data for the three case study hydro schemes: the associated literature, desk study notes and a map demonstrating viewpoints where photographic data was collected are presented for each scheme. Further viewpoint photographic data is available upon request. Industry guidance was consulted throughout the exercise.

1.1 Gleann Casaig hydro scheme data

Literature consulted during the desk study for this hydro scheme is listed below. Table 4 summarises the key points noted.

- *Environmental Statement* (Dulas Ltd, 2014a)
- *Landscape Clerk of Works reports numbers 1-5* (Green Cat Renewables, 2016)

Table 4. Key points noted during Gleann Casaig hydro scheme desk study

Gleann Casaig hydro scheme desk study notes
Dulas Ltd (2014a) – • Wildness buffer area & adjacent to core wildness (p.47) • Tracks by pipeline to be temporary (p.48) • Upgrading to existing track, new track extension and footpath (p.48) • Reinstatement to include turfing and use of on-site materials (p.48) • Area description (pp. 61-63) • SNH (2015a) guidance to be used (p. 63) • Gains to area include track upgrades and new footpath (p. 63) • Footpath determined “borderline significant”; track extension “not significant” (p. 72) • No overall significant landscape designation effects; woodland mitigation (p. 79) • Natural reseeding in landscape areas (Appendix 4-1, p. 11) • Reinstatement of tracks to “final finish”; sediment management to remain in places to allow re-vegetation (Appendix 4-1. p. 11) *LCoW reports –* • South-eastern track quality deteriorated due to wet weather and construction vehicle use (August: p. 1) • Footpath constructed with on-site materials; penstock causing it to look unnatural during construction and should naturalise upon completion (August: p. 5)

- Widening of one section of existing track for vehicle access; passing places & installed culverts are subtle (May: p.1)
- Footpath appears geometric and encourages to keep with hillside curves; thought revegetation will lessen impact and narrow footpath (June: p. 1)

Figure 21 shows a hydro scheme access track map and plots viewpoints where photographic data was collected during the site visit.

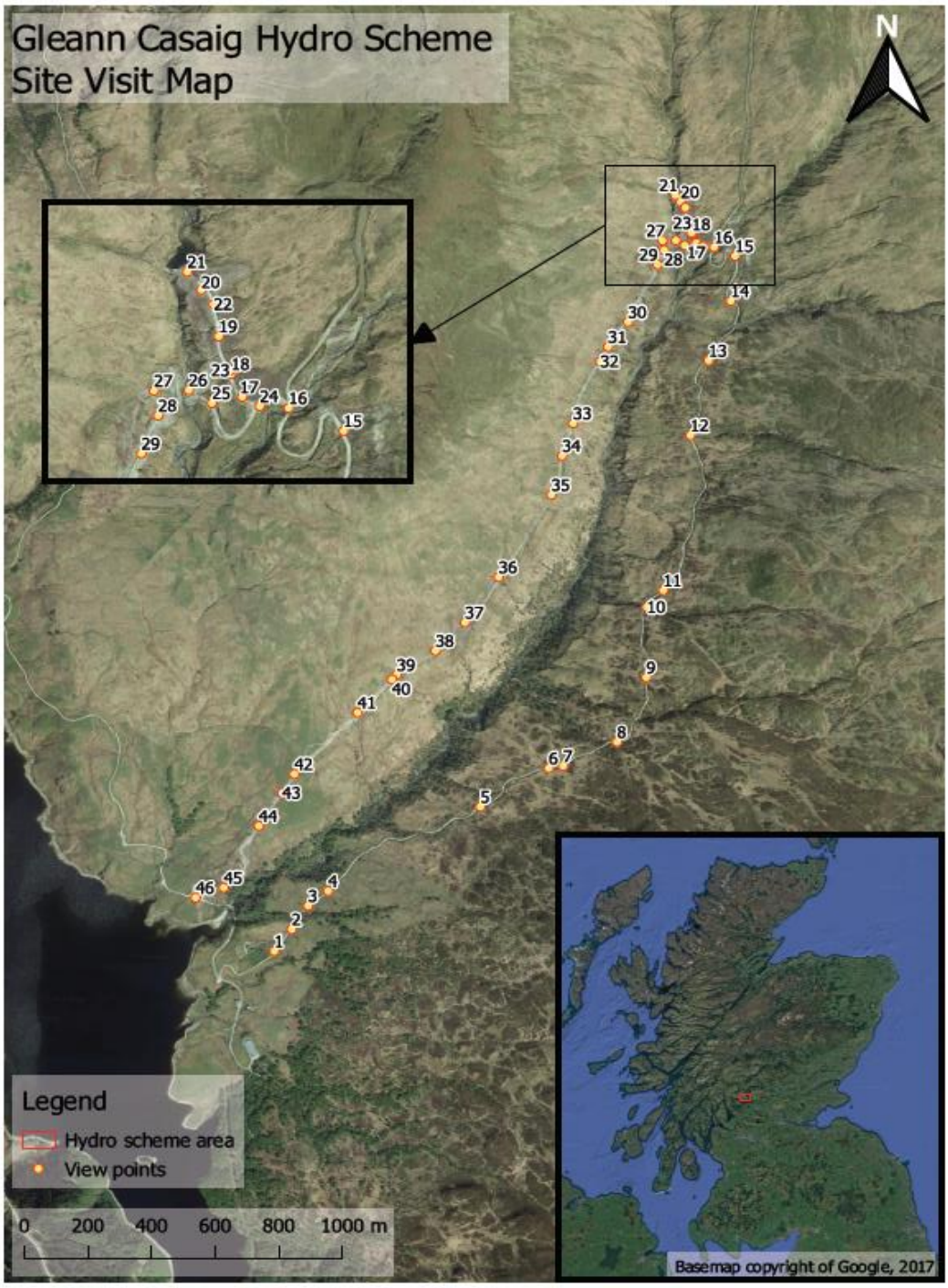

Figure 21. Map of Gleann Casaig hydro scheme with data viewpoints. Map created using QGIS, coordinate system: British National Grid.

1.2 Derrydarroch hydro scheme data

Literature consulted during the desk study for this hydro scheme is listed below. Table 5 summarises the key points noted.

- *Environmental Statement* (Hydroplan UK, 2009a: Ch. 5, pp. 1-23)
- *Landscape Clerk of Works reports numbers 1-8* (Mike Hyatt Landscape Architects, 2014 & 2015)

Table 5. Key points noted during Derrydarroch hydro scheme desk study

Derrydarroch hydro scheme desk study notes		
Intake 4	**Intake 3**	**Intake 2**
Hydroplan UK, 2009a: Ch.5 – • Route changes might occur due to archaeology (p.11) • Track construction from borrow pit material (p.11) • Turves to be stripped and kept separately; continued growth is encouraged (p. 11) • Stripped area to be recovered with peat, turf and boulders on the surface in fitting with landscape (p. 11) • Drainage (cut off) and angled culverts underneath track (p.11) • Use best practice guidance for restoration and upgrading (p.3) • Re-use of peat and turf within a few hours (p.3) • Widening of track to be considered to avoid steep slopes; otherwise, track to be kept to minimum (p.3) • Avoidance of steep slopes to facilitate re-soiling, vegetation	*Hydroplan UK, 2009a: Ch.5 –* • Existing track (500m) widened for machinery access and extended by 1000m (p. 16) • Temporary track (p. 5 & 16) • Constructed from spoil heap material (p.16) • Avoidance of deep peat excavation (p. 18) • Access track to be close to the pipeline for construction purposes (p. 18) • Turves to be stripped and kept separately; continued growth is encouraged (p. 19) • Stripped area to be recovered with peat, turf and boulders on the surface in fitting with landscape (p. 19) • Foreign material to be removed and hard areas to be covered with subsoil and organic material (p. 17) • Excavated rock used for roadway (p.17)	*Hydroplan UK, 2009a: Ch.5 –* • Excavated peat soil heaped separately from other soils (p. 21) • Turves to be reinstated as soon as possible and with an irregular shape (p. 21) • Access track to be kept for hydro scheme operation and routine maintenance (monthly); recommends using quad bikes for continued access (p. 22) • Reference to SNH (2015a) (p. 22) • As per intake 4 (p.3)

establishment and to conform with landform (p.3) • Finish tracks with excavated stone from site (p.3) • Restoration of verges/cuts to be done consecutively for quick integration into landscape (p.3)	• Reference to SNH (2015a) (p. 22) • As per intake 4 (p.3)	

LCoW reports –

- Track construction complete and reinstatement started along edges; turf pulling needed for width reduction (Report 5: p. 9)
- Some areas of reinstatement going well and match landform(Report 5: p. 12)
- Track reinstatement ongoing throughout construction (Report 8: p.5)
- Track in good condition with some localised drainage issues owing to track surface (Report 8: p.5)
- Central strip to be laid with frequent 2-3m gaps to allow water to drain into ditches (Report 8: p. 5)
- Central strip of turf high but this is dictated by turf (Report 8: p.9)
- Central strips satisfy planning conditions (Report 8: p.9)
- Indicates monitoring visit in Spring 2016 (Report 8: p.9)

Figure 22 shows a hydro scheme access track map and plots viewpoints where photographic data was collected during the site visit.

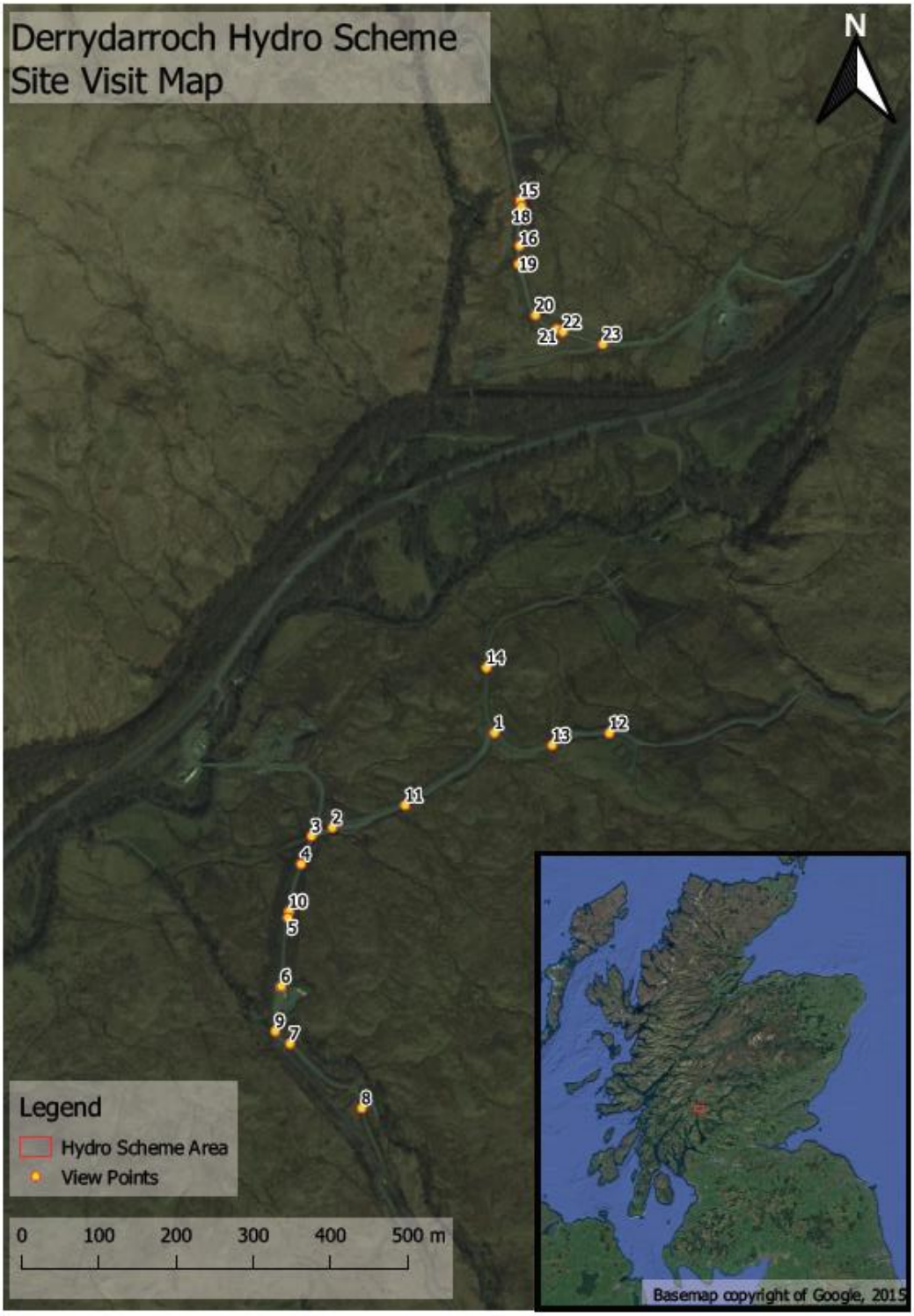

Figure 22. Map of Derrydarroch hydro scheme with data viewpoints. Map created using QGIS, coordinate system: British National Grid.

1.3 Upper Falloch hydro scheme data

Literature consulted during the desk study for this hydro scheme is listed below. Table 6 summarises the key points noted.

- *Environmental Statement* (Hydroplan UK, 2009b: Ch. 5, pp. 1-5)
- *Landscape Clerk of Works reports numbers 1-8* (Mike Hyatt Landscape Architects, 2014 & 2015)

Table 6. Key points noted during Upper Falloch hydro scheme desk study

Upper Falloch hydro scheme desk study notes
Hydroplan UK, 2009b: Ch.5 – • Monitoring and continued management over 3 year post-construction period (p.3) • Use best practice guidance for restoration and upgrading (p.3) • Re-use of peat and turf within a few hours (p.3) • Widening of track to be considered to avoid steep slopes; otherwise, track to be kept to minimum (p.3) • Avoidance of steep slopes to facilitate re-soiling, vegetation establishment and to conform with landform (p.3) • Restoration of verges to be done in conjunction with track formation to facilitate landscape integration (p.3) • Finish tracks with excavated stone from site (p.3) • Reference to SNH (2015a) (p.4) • Access track to be kept for hydro scheme operation and routine maintenance (monthly); recommends using quad bikes for continued access (p. 4) • Reinstatement of vegetation as per pre-construction (p.4) • Turves to be of irregular shape; replaced as soon as possible (p.4) • Use existing access tracks (p.4) • Preferred use of locally won material from uphill borrow pits (p.4) • Avoidance of deep peat may require track re-routing (pp. 4-5) • Permanent new track (p.5) • Existing tracks of reasonable condition but require re-alignment (widening) and upgrading using spoil material (p.5) • Passing places to be implemented every 500m and at pipe change sections, or as topography allows (p.5) • Restoration of verges/cuts to be done consecutively for quick integration into landscape (p.3) *LCoW reports –* • Cut slopes to be reworked ; banks partially turfed and slippage evident in places (Report 6: p5) • Turf repositioning necessary (Report 6: p.5)

Upper Falloch hydro scheme desk study notes
• Track edges to have turfs spread (Report 6: p. 7) • Cut material from track sides to be used to reduce slope angles and help re-vegetation (Report 6: p. 7) • Existing tracks to be reduced to original width and regrade slope without disturbing vegetation (Report 8: p.4) • Reinstatement to match standard of other new tracks (throughout schemes) (Report 8: p.4) • Slope angles to be reduced to allow soil/turf to sit and not slide or erode; will also reduce track width (Report 8: p.4) • Track reinstatement ongoing throughout construction (Report 8: p.5) • Track in good condition with some localised drainage issues owing to track surface (Report 8: p.5) • Central strip to be laid with frequent 2-3m gaps to allow water to drain into ditches (Report 8: p. 5) • Central strip of turf high but this is dictated by turf (Report 8: p.9) • Central strips satisfy planning conditions (Report 8: p.9) • Indicates monitoring visit in Spring 2016 (Report 8: p.9)

Figure 23 shows a hydro scheme access track map and plots viewpoints where photographic data was collected during the site visit.

Figure 23. Map of Upper Falloch hydro scheme with data viewpoints. Map created using QGIS, coordinate system: British National Grid.

Appendix 2. Interview results table

Table 7 provides details of key themes and points arising from analysis of interview transcripts. Appendix 3 contains the interview guide and notes.

Table 7. Key themes arising from interviews

Key theme	Key points raised and number of participants in agreement per point (out of three) (e.g. *point raised,* 3/3)	Example quotes from transcripts
Reasons for potential neglect of landscape impacts mitigation	• Cost and time (for developer and/or contractor), 3/3 • Attitude (of developer and/or contractor) or differing principles (across all parties), 3/3 • Lack of communication (across all parties), 3/3 • Inexperience and poor planning (across all parties), 3/3 • Restoration and/or reinstatement not prioritised (by developer and/or contractor), 2/3 • Poor weather, 3/3 • Consequences of poor practice unknown or not catered for by planning system, 2/3 • Lack of post-construction site monitoring or feedback (across all parties), 3/3	"In terms of the contractors, they want to make their pound of flesh at the end of the project… if they see a machine which is costing hundreds of pounds a day to run and they see it sitting on essentially the same piece of ground working over and over, trying to get this thing to look right, then they start to get a bit nervous... the cost pressure is quite a big deal and sometimes, you know, the less diligent contractors can allow that to affect the way they do the scheme." (Participant A) "… nobody picks them up on it then they'll just get away with it basically… because the restoration is usually mostly at the end of the project and they're keen to get off site, sometimes they just don't do what they've been asked to do. And then my involvement finishes quite often. I'm not often asked to go back and do check after projects are practically complete" (Participant B) "… (the developer is) spending money on this and that needs to be done in order to meet such and such a requirement…

Key theme	Key points raised and number of participants in agreement per point (out of three) (e.g. *point raised,* 3/3)	Example quotes from transcripts
		(landscape mitigation is) something that I think would help improve it (the scheme) but not something it requires in order to function." (Participant C)
Reasons for landscape impacts mitigation working well	• Clear and continued communication of expectations (across all parties), 3/3 • Increased engagement with planning authority and SNH or equivalent (for complex designs), 2/3 • Continued learning (all parties), 3/3	"conversations are very important and… engage with SNH in advance of putting in planning applications to make sure they're likely to be happy with it" (Participant A) "(contractors) some of them are very, very good and the digger drivers are enormously skilful and they can… return the landscape to what it looked like before they arrived on site just as long as they're given the right guidance and at the right time and the resources to actually do it" (Participant A) "Because the most important thing is to be able to work with the contractor. The guy in the machine, to get him to actually do it, to go through the actual physical work of restoring path edges and if he doesn't know what he's doing then you're struggling really. So it's having the base knowledge so that then we can pass that on as well." (Participant B) "I didn't have too much interaction to be honest… (the planning authority) did come back a couple of times asking for more information and there was some comments that I feel like maybe could have been better served during the process... the LCoW

Key theme	Key points raised and number of participants in agreement per point (out of three) (e.g. *point raised,* 3/3)	Example quotes from transcripts
		has a requirement to submit a report maybe it should be that the other side also has a requirement to submit a response." (Participant C)
Role and influence of the LCoW	• Balancing act; a difficult position between contractor, developer and other stakeholders, 3/3 • Increased influence if present on site and/or informed of site activities, 2/3 • Time on site could be increased (where necessary), 2/3 • Improved if involved with EIA process, 2/3 • Must communicate expectations clearly to influence outcome, 3/3	"…there's a saying about never let your boss see a half completed job… because they might come on site and see a scheme which involves extensive earthworks… and the place looks like the Somme… it can be a bit awkward to take SNH round a site like that and look at the horrified looks on their face when you know that if they came back in three months' time, everything would look absolutely fine." (Participant A) "I think there just needs to be a lot more put in about how the reporting is going to work and… the number of visits and that's agreed throughout the contract. To me, it's just the fact that the input from LCoWs, in my experience, can be a bit light. You know, to actually provide the best advice… it then requires SNH or whoever is going to check to be able to put in the time as well" (Participant B) "It'd be a very different experience, you know, from doing the LCoW for a design that you come up with and that way you would have more of a feeling for what the real concept was and what they were trying to achieve... Whereas when you're brought in just

Key theme	Key points raised and number of participants in agreement per point (out of three) (e.g. *point raised,* 3/3)	Example quotes from transcripts
		(for) LCoW work it's more just about… following the basic principles of not ruining the landscape essentially" (Participant C)
Opinion on SNH (2015a) *Constructed tracks in the Scottish Uplands* guidance and/or site specific advice	• Guidance is comprehensive for landscape professionals, 2/3 • Guidance is too extensive for consultation by all developers and/or contractors, 3/3 • Guidance content does not target developer and/or contractor readership, 3/3 • Site advice can be used to back up LCoW instructions, 2/3	"(It is) leverage… (to say) 'do a good job here or SNH will be unhappy and we will not get consent for the next scheme or, if we do get consent, you will not get the contract to build it'." (Participant A) "Maybe they might have read it in the mists of time but I doubt if they would read it regularly. They might do, one or two of them might do it. It's quite a daunting document. That's the trouble… and certainly not digger driver friendly, and it's to some extent not contractor friendly. It depends on the… contractor, of course, how willing they are (to) spend time reading through guidance" (Participant A) "I think that the guidance is pretty extensive but I think it has all kinds of key elements where maybe some update could be done" (Participant B) "I'd hope the lead contractor has read the guidance. I would say I'm only 60 percent sure that that would be the case" (Participant C)

Key theme	Key points raised and number of participants in agreement per point (out of three) (e.g. *point raised,* 3/3)	Example quotes from transcripts
Suggested improvements to SNH (2015a) *Constructed tracks in the Scottish Uplands* guidance and/or site specific advice	• Present guidance practically (e.g. laminated, condensed, etc.), 3/3 • Adapt content to better suit developer and/or contractor readership (e.g. action and outcome orientated), 3/3 • Increase use of visual aids (e.g. photos, drawings, etc.), 3/3 • Increase use of best practice case studies, 3/3	"What they'll want is some guidance on how to build a track and how to make it look okay. I would say that if you majored on that, especially with pictures and pictures with labels… (it) would be great. You know some stuff they can actually look at which says 'this is good because blah blah blah, this is bad because blah blah blah'." (Participant A) "I think that there needs to be more kind of emphasis on case studies to show developers good practice and what is possible if they have the right people, the right knowledge." (Participant B) "… a visual tool like that to show someone, I like that. You can say, 'see this picture? Do it exactly like that and I'll be happy and do not do it like this'… I do think the more visual tools you have the better… They are worth so much more… the more visual aids in the document, whether that's sketches, photographs, drawings… the better because it's the easiest way to explain to someone" (Participant C)

Appendix 3. Interview data

Presented herein are the interview questions and notes. Transcripts have been omitted to protect participant anonymity and confidentiality.

3.1 Interview questions

Research questions:

- Difference between CMS/EIA (and any revisions) and reality of track/impact of track?
- How can SNH guidance and consultation advice be improved to promote better practice re landscape impacts from tracks?

Core interview questions:

- In your experience, when SNH has raised issues (e.g. landscape impacts from track design/construction/restoration)
- How has it been useful?
- In what ways did it instigate changes to the design, construction and/or restoration?
- How has it been received by the developer/contractor?
- What are some of the reasons why issues might not be addressed?
- When appointed as a Landscape Clerk of Works (LCoW) how much time do you spend on site and how often do you tend to be on site?
- How might this influence the outcome re landscape impacts arising from tracks?
- Describe the extent of your communication with SNH whilst employed as a LCoW?
- How might SNH improve the delivery of their general landscape guidance* and site-specific advice?
- How might the consultation process as a whole (SNH – Planning Authority – Developer/Contractor) be improved?

* https://www.nature.scot/constructed-tracks-scottish-uplands

Possible follow-ups:

- To your knowledge, what extent were developers/contractors aware of SNH general landscape impact guidance (Constructed Tracks guidance)? Why is this?
- To your knowledge, what extent were developers/contractors aware of SNH site specific advice re landscape impacts provided as part of the EIA consultation process? Why is this?

3.2 Interview notes

Table 8. Interview one details

Interview 1			
Consent	Yes, including audio recording (via email)		
Location	Telephone	**Time/Date**	4.15pm, 6th March 2019
Participant pseudonym	Participant A	**Duration**	32 minutes
Notes	Participant requested core questions in advance. Written answers to core questions were returned via email and followed up during interview. No workplace noise was audible over the phone (no known distractions). Researcher was at home and the environment was quiet. Recap of research area and questions given immediately before interview recording commenced. Once interview concluded, the audio recording was stopped and a discussion of approximately 10 minutes followed on the subjects of EIA work, the LCoW role and professional bodies.		

Table 9. Interview two details

Interview 2			
Consent	Yes, including audio recording (in person)		
Location	In person - café	**Time/Date**	10am, 20th March 2019
Participant pseudonym	Participant B	**Length**	50 minutes
Notes	Participant requested core questions in advance. Audio equipment failed twice throughout course of interview, resorted to detailed note taking and participant offered to provide lost information via email or telephone. Participant suggested location that was quiet excepting occasional noise from a coffee machine (occasional distraction). Recap of research area and questions given immediately before interview commenced. Once interview concluded, a discussion of approximately 10 minutes followed on the subjects of EIA work the CoW role and dissertation. Participant issued one of their LCoW reports to serve as an exemplar without prompting. Participant requested to be kept informed of research results.		

Table 10. Interview three details

Interview 3			
Consent	Yes, including audio recording (via email)		
Location	Telephone	**Time/Date**	3.30pm, 27th March 2019
Participant pseudonym	Participant C	**Length**	55 minutes
Notes	Participant was provided core questions for consistency with other interviews. Workplace noise (talking) was audible over the phone (occasional distraction). Researcher was at home and the environment was quiet. Recap of research area and questions given immediately before interview commenced. Once interview concluded and audio recording stopped, a discussion of approximately 10 minutes followed on the subjects of EIA work, the CoW role and MSc dissertation.		