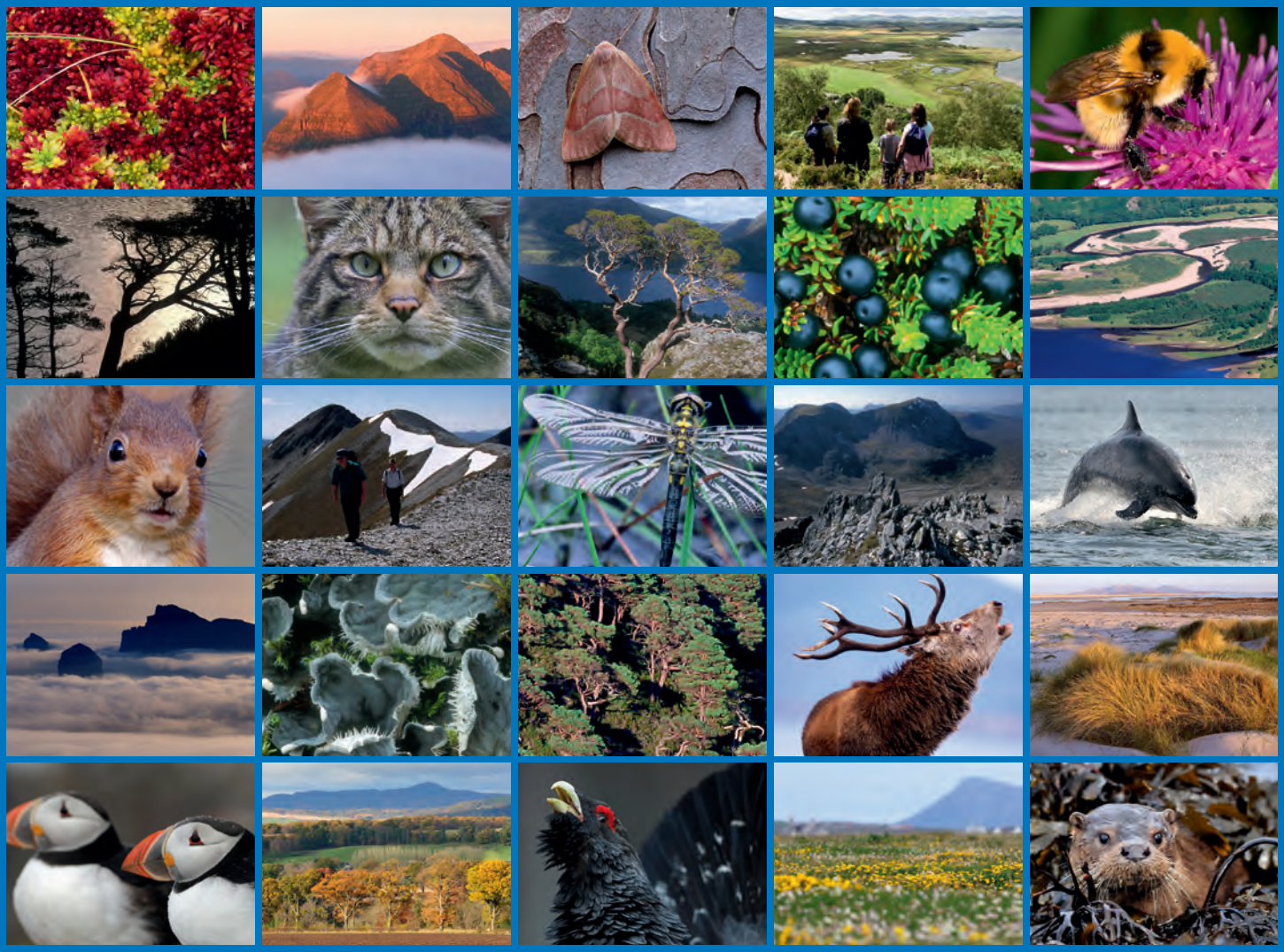
Scottish Natural Heritage
Commissioned Report No. 877

Hazel gloves fungus (*Hypocreopsis rhododendri*) survey of mid Argyll



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COMMISSIONED REPORT

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Hazel gloves fungus (*Hypocreopsis rhododendri*) survey of Mid Argyll

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This report should be quoted as:

Acton, A. 2016. Hazel gloves fungus (*Hypocreopsis rhododendri*) survey of Mid Argyll. *Scottish Natural Heritage Commissioned Report No. 887.*

COMMISSIONED REPORT

Summary

Hazel gloves fungus (*Hypocreopsis rhododendri*) survey of Mid Argyll

Commissioned Report No. 877
Project No: 13830
Contractor: Andy Acton
Year of publication: 2016

Keywords

Hypocreopsis rhododendri; hazel gloves fungus; Atlantic hazel; lichens; Argyll.

Background

Hypocreopsis rhododendri, the hazel gloves fungus, is a priority species on the UK BAP and Scottish Biodiversity List. It is Nationally Scarce and mostly found on hazel in Atlantic hazelwoods. In Scotland, the fungus occurs in Atlantic hazelwoods on the west coast, as a component of the species-rich, hyperoceanic variants of the *Graphidion* lichen community.

Scotland is a stronghold for the UK hazel gloves population which is vulnerable to loss due to habitat deterioration. There are survey gaps within the known range of Scottish hazel gloves populations. Most of the survey work undertaken to date has concentrated on Skye, Mull and Lorn. A notable gap occurs to the south and west and despite the extent of its ancient woodland resource Mid Argyll is markedly under surveyed. This project will identify where the key sites for this species are, their characteristics and what condition they are in and their potential for expansion through new planting or inclusion in positive land use strategies.

Main findings

- Although only one new location for hazel gloves *H. rhododendri* was found, the survey identified a number of Atlantic hazel stands that supported notable lichens of the *Lobarion pulmonariae* community and hyperoceanic variants of the *Graphidion scriptae* community.
- Populations of many of the notable lichen species in many of the study sites are small and with questionable viability.
- A number of sites require remedial management to ensure continuity of the hazel habitat, especially with regard to the lichen flora.
- At a number of sites there is good potential for expansion of the hazel habitat.

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Table of Contents **Page**

Acknowledgements

Marina Pugh (SNH) for letting the contract and useful discussions on methodology, Patricia Bruneau (E&B Geodiversity Upland Peatland Group) for developing guidelines for the soil sampling, Anna Griffith for discussions on method and reporting, John Douglass for help with the fieldwork, Philippa McKee (FC) for sorting access permissions on FC sites, Brian Coppins (for discussion and help with selection of target species), Landowners/occupiers for access permissions. Particular thanks to those landowners/occupiers who provided useful details on site management and one particular landowner for the turnips. Special thanks to Margaret McKeown (Administrative Officer at AFRC:RPID in Oban) for sourcing the access information without which the project could have become unmanageable. And to Marina again for arranging letters requesting access permissions to be sent out to landowners.

1. INTRODUCTION

1.1 Background

Hypocreopsis rhododendri, the hazel gloves fungus, is a priority species on the UK BAP and Scottish Biodiversity List. It is Nationally Scarce and mostly found on hazel in Atlantic hazelwoods. In Scotland, the fungus occurs in Atlantic hazel woodlands on the west coast, as a component of the species-rich, hyperoceanic variants of the *Graphidion* lichen community.

Scotland is a stronghold for the UK hazel gloves population which is vulnerable to loss due to habitat deterioration. There are survey gaps within the known range of Scottish hazel gloves populations. Most of the survey work undertaken to date has concentrated on Skye, Mull and Lorn. A notable gap occurs to the south and west and despite the extent of its ancient woodland resource Mid Argyll is markedly under surveyed. This project will identify where the key sites for this species are, their characteristics and what condition they are in and their potential for expansion through new planting or inclusion in positive land use strategies.

In order to determine the best strategy for safeguarding the Atlantic hazelwood resource in mid Argyll we need up to date information about all extant sites.

1.2 A Need for Long Term Monitoring

Hazel gloves fungus is considered to represent a 'flagship' species for undisturbed ancient woodlands so the project benefits will not be restricted to this species alone. The project will be instrumental in raising awareness of the wider ancient woodland habitat in accordance with the ecosystem approach adopted by the Scottish Biodiversity Strategy.

Improving knowledge and understanding of the distribution, habitat characteristics and requirements of the hazel gloves fungus and recognising its importance as an indicator of habitat quality for Atlantic hazelwoods across Mid Argyll is fundamental to the success of this project.

The development of the Atlantic Hazel Site Assessment protocol (Coppins & Coppins, 2012) has provided a valuable toolkit to facilitate the longer term monitoring of sites for hazel gloves and other key species as indicators of Atlantic hazelwood. It will be adopted by this project to assist in identifying those aspects of hazelwood ecology which correlate positively with the occurrence of the hazel gloves fungus.

1.3 Legacy

The greatest threat to Atlantic hazel woodland is the destruction of its scrub habitat through inappropriate management such as coppicing and continuous heavy grazing. Disruption of the natural processes leads to loss of habitat structure and ecological continuity upon which *Graphidion* and *Lobarion* [lichen] communities depend.

A greater understanding of the distribution of hazel gloves fungus in Mid Argyll and the factors which are likely to influence this distribution better equips SNH to influence mainstream land use strategies such as the Scottish Rural Development Programme (SRDP) and Forestry Design Plans (FDP`s) for the benefit of the Atlantic hazelwood habitat. Understanding the relationships between the hazel gloves fungus and the locations in which it is found will enable us to fine tune management advice as well as being able to identify potential new sites which fit the criteria for both the management of existing and creation of new habitat.

2. METHODOLOGY

2.1 Study sites

Geographic Information Systems (GIS) data from the Native Woodland Survey of Scotland (NWSS) was used to identify hazel stands in the Mid Argyll study area (Figure 1). The data was examined and a subjective decision made to filter the data to include sub-compartments with a cover of more than 20% pole-stage hazels 7-15 cm dbh* (defined by NWSS as stems 7-20 cm diameter at breast height (dbh)) and with a pole density of more than 100 stems/ha and with a total cover of hazel >30%. Maps were produced of the survey polygons and sites were prioritised on the basis of percentage cover of hazel and practicalities such as work planning. For example very small isolated sites were often discarded in preference for clusters of suitable sites to enable the maximum number of sites to be visited within the limited time available. In total 108 potential survey sub-compartments were identified within the area of search (Figure 1).

Landownership information was collated from the Integrated Administration and Control Systems (IACS) by the Scottish Rural Payments and Inspections Directorate (SCRPID). SNH sent out letters requesting access permissions prior to fieldwork. Many landowners gave permissions but a number did not reply and several landowners refused permissions.

2.2 NWSS environmental data

NWSS data was collated for the survey sub-compartments including sub-compartment area in hectares (ha); the percentage cover of hazel; the dominant habitat and data on the percentage cover and pole density (stems/ha) of three structure classes of hazel (established hazel regeneration, pole stage hazel and mature hazel).

2.3 Field survey data

The types of data collected in the field is summarised in sections 2.1.1-2.1.5. The field survey guidelines and forms (Annex 2) give further guidelines on the field recording method. Surveys took place between February and March in 2013.

2.3.1 Environmental data

Additional environmental data was collected during the fieldwork including: the dominant habitat (as assessed by the surveyor), the distance of the sub-compartment from the coast, the hazel stand types in the sub-compartment, sub-compartment aspect, soil pH (samples were collected for analysis back in the laboratory following guidance developed by SNH for this project – see Annex 1) and whether a significant proportion of the sub-compartment was associated with streams, rivers or lochsides. An assessment was made of the potential for the woodland based on the surveyor's experience of whether there were suitable niches available for expansion. Where numerous isolated stands of woodland were present that appeared to represent fragments of a formerly more expansive woodland then potential was considered to be excellent (provided the intervening ground was still suitable for woodland).

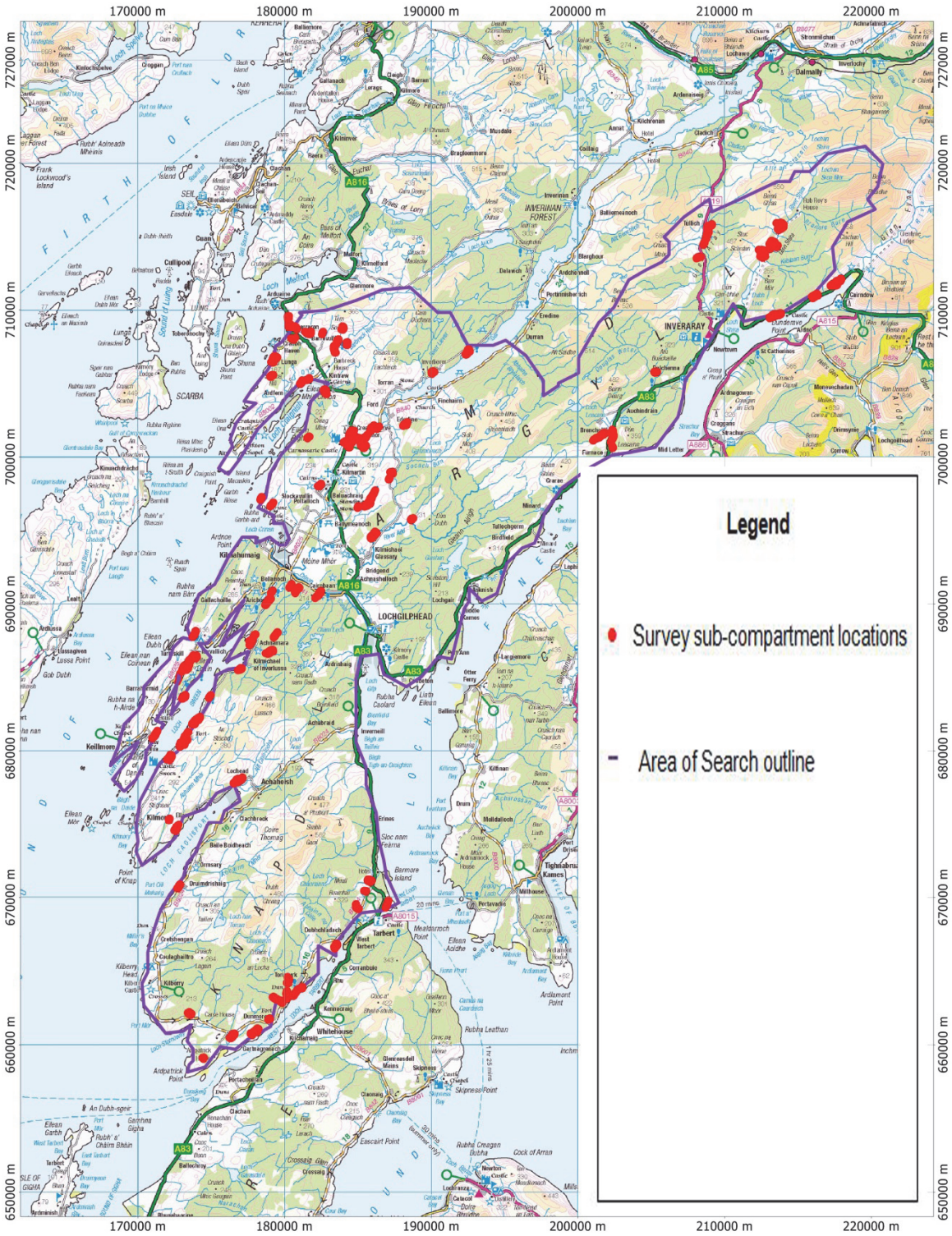

Figure 1. The locations of 109 hazel-rich survey sub-compartments (red areas) identified in the Area of Search (AoS) as indicated by the purple line. Note the sub-compartments are not to scale – they only indicate the locations (they have been enlarged to make them visible on this map). The GIS shapefile of the AoS provided by SNH was roughly drawn so some sub-compartments appear to be just outwith the area. Surveyor discretion was used in cases of doubt. (© Crown copyright and database right 2011. Ordnance Survey 100017908).

2.3.2 Data on hazel stand structure and condition

Data on hazel stand structure and condition including:

- A subjective assessment of the frequency/abundance of live and dead hazel stems within size classes (3-7 cm dbh, 7-15 cm dbh and >15 cm dbh). Note that the NWSS pole stage is defined as 7-20 cm dbh, following the NWSS guidance for birch (FC, 2010). For the purposes of this hazel gloves project, 3-7 cm are considered to be young and maturing stems, 7-15 cm 'mature' stems, and stems >15 cm dbh are considered to be 'large, old' stems.
- A subjective assessment of the number of hazel seedlings/young saplings (<1.5 m tall) and saplings (>1.5 m tall).
- An assessment of whether basal shoots were currently all suppressed on most hazel stools in the sub-compartment.
- A subjective assessment of whether at least one in five hazels have at least one successful shoot <3 cm dbh reaching (or nearly reaching) the canopy. This lower threshold was based on the guidelines for Atlantic hazel habitat condition included in the Hazel Assessment Tables (Coppins & Coppins, 2012).

2.3.3 Data on hazel gloves fungus

Field survey data on hazel gloves fungus included:

- The number of trees/shrubs with hazel gloves in the sub-compartment.
- The total number of stromata in the sub-compartment.
- The frequency of glue fungus (*Hymenochaete corrugata*) in the sub-compartment.

The main information recorded at each plot is outlined below (for further information refer to the results (Annex 3). Recording was undertaken at each plot at a number of scales.

2.3.4 Data on the lichen flora

Field survey data on the lichen flora included:

- A subjective assessment of how frequent/abundant the *Lobarion* and *Graphidion* communities were on hazel in the sub-compartment.
- The frequency/abundance of a number of *Lobarion* and *Graphidion* target species. Target species were selected on the basis of surveyor experience and in discussion with the lichenologist Brian Coppins. The target species are listed in Table 1.

Table 1. The 15 target lichen species for the Hazel Gloves Project. The first eight species are Lobarion species. The next seven species are Graphidion species. Six of the Graphidion species are hyperoceanic (Thelotrema lepadinum is not restricted to oceanic areas but is still a good 'old woodland' indicator). Codes for Conservation status follow Wood & Coppins (2012) where BAP= Biodiversity Action Plan species; E = endemic species; IR = International Responsibility species; LC = Least Concern, NS = Nationally Scarce; NR = Nationally Rare; NT = Red Data Book Near Threatened; Sc = Scottish Biodiversity List species; S8 = Schedule 8 species; VU = Red Data Book Vulnerable. For explanations of these terms refer to Woods & Coppins (2012).

Target species	Conservation Status	WSIEC status
Collema fasciculare	**NT NS BAP Sc IR**	WSIEC
Fuscopannaria sampaiana	**NT NS BAP Sc IR**	WSIEC
Leptogium brebissonii	**NT NS BAP Sc IR**	WSIEC
Leptogium burgessii	**LC Sc IR**	WSIEC
Pseudocyphellaria crocata	**LC Sc IR**	WSIEC
Pseudocyphellaria intricata	**NT NS BAP Sc IR**	WSIEC
Pseudocyphellaria norvegica	**LC NS BAP Sc IR**	WSIEC
Parmeliella testacea	**NT NS BAP Sc IR**	WSIEC
Bactrospora homalotropa	**LC NS Sc IR**	WSIEC
Graphis alboscripta	**NT NR E BAP Sc IR**	WSIEC Bonus
Pyrenula laevigata	**LC NS Sc IR**	WSIEC
Pyrenula occidentalis	**LC Sc IR**	WSIEC
Thelotrema lepadinum	**LC**	-
Thelotrema macrosporum	**LC NS Sc IR**	WSIEC
Thelotrema petractoides	**LC Sc IR**	WSIEC

2.3.5 Management impacts on hazel

Any evidence of cutting/coppicing of hazel was noted as was the impact of grazing/browsing with specific reference to hazel. Specifically the surveyor was asked to answer three questions that would indicate the condition and viability of the hazel stand as a habitat for lichens:

- In the surveyors opinion do a significant number of hazels require a flush of basal regeneration in the near future to prevent loss of hazels/decline of hazel stand?
- In the surveyors opinion does a significant proportion of the stand require a flush of basal regeneration in the near future for continuity of *Graphidion* habitat?
- If hazel stands are present in the sub-compartment, are they dominated by tree form hazels?

2.4 Constraints

Time was probably the main constraint. It is not unusual to find hazel gloves fungus on only one or two hazels in a woodland, in which case it would be easy to overlook during such a rapid survey. However, estimated surveyor coverage of the survey sub-compartments was medium to high at most sites (see Annex 3) so it is unlikely the fungus would have been overlooked if it was well established and fairly common at a site. On average 2.5 h were spent surveying each site so, taking into account the additional time required for travel between sites and walking to a site, it is generally feasible to collect sufficient data for this project at a rate of two small to medium sized sites per day (refer to data in Annex 3 for full details on site sizes and number of hours spent on site).

Although many of the target species were fairly conspicuous species, one of the *Graphidion* target species (*Bactrospora homalotropa*) is fairly inconspicuous and easily overlooked during a rapid survey. In retrospect *B. homalotropa* was not a good target species and frequency data for this species are probably unreliable. Another *Graphidion* species *Thelotrema macrosporum* is probably often overlooked as small fruited forms of *Thelotrema lepadinum* unless inspected very closely. The *T. macrosporum* data is useful and it is a good target species for this project, but care should be taken in interpretation of the data for this species as the frequency/abundance could be under-estimated at some sites.

3. RESULTS

The fieldwork was conducted in winter 2013 by two lichenologists, Andy Acton and John Douglass. Maps of the sub-compartments are given in Annex 4. The detailed survey data is presented in Annex 3 and 5 and summarised in sections 3.1-3.5 below.

3.1 Occurrence of hazel gloves fungus and glue fungus

Hazel gloves fungus was only recorded in one sub-compartment with one stroma on one hazel (at Lergychoniebeag, NM 82591 08438, see Annex 5). It may of course been overlooked in other compartments, especially if it was present but not fruiting, very localised, present at low frequency, stromata were small or old and disintegrating. No stromata were recorded in a sub-compartment where hazel gloves was recorded in 2011 by Judith Witts (at Drimfern, NN 085 145). No stromata were recorded in two sub-compartments adjacent or very near to hazel stands where hazel gloves fungus has previously been recorded (a 2011 record at Knapdale, NR 80932 91144, by Richard Thompson and Philippa McKee, and a record by Rosemary Neagle at Carnassarie at NM842 009).

Hazel gloves fungus appears to parasitize the glue fungus (*Hymenochaete corrugata*) (Grundy, 2014) and glue fungus was present in all sub-compartments. Glue fungus was scarce or rare in only five sub-compartments, occasional in 10 and at least locally frequent to abundant in 29 of them. Therefore, it is possible that repeat visits to sub-compartments could find hazel gloves.

3.2 Data on hazel stand structure and condition

- Thirty two of the sub-compartments appear to be old or long established woodland (or predominantly old woodland), two are predominantly secondary woodland of recent origin, and another two sub-compartments could not be allocated to either category with any confidence. Stands were subjectively assessed in the field as long established based on surveyor experience using such factors as the presence of old woodland indicator lichens and stand characteristics such as the presence of veteran trees. A desk study comparing site maps with old maps (e.g. the Roy Military maps and First Edition OS maps) would also be useful but this was not done as part of this project.
- Twenty nine of the sub-compartments had at least some stems >15 cm dbh (i.e. large, old hazel stems) and of these, 21 had plenty of stems >15 cm dbh (a good sign of potentially very good habitat for *Lobarion* species).
- Two sub-compartments were dominated by tree form hazels. One of these also had a flush of basal regeneration, so the future of the stand is probably secure. Another stand of tree form hazels requires a flush of basal regeneration.
- Basal shoots are currently all suppressed on most hazel stools in 12 of the sub-compartments i.e. current levels of browsing are such that if they persist for long periods, the hazel stands will deteriorate.
- Ten of the sub-compartments assessed do not have at least four in 20 (i.e. one in five) hazels with at least one successful shoot <3 cm dbh reaching (or nearly reaching) the canopy.
- In total 14 sub-compartments have basal shoots suppressed and/or do not have at least one successful shoot <3 cm dbh reaching (or nearly reaching) the canopy.
- Nine sites have currently suppressed basal regeneration and do not have one in five hazels with at least one successful shoot <3cm dbh reaching the canopy. These are the sub-compartments most at risk due to browsing levels.
- Only three sub-compartments were assessed as having plenty of hazel seedlings and/or young saplings <1.5 m tall. No hazel regeneration <1.5 m was recorded in 21

sub-compartments. The other sub-compartments had hazel regeneration <1.5 m tall but it was mostly suppressed by browsing.

- No hazel regeneration >1.5 m was recorded in 11 of the sub-compartments. Although some regeneration >1.5 m was present in 31 sub-compartments, it was generally scarce (with 'some' recorded on the recording forms in Annex 3). Regeneration >1.5 m was only recorded as plentiful ('plenty' recorded on the recording forms) in four sub-compartments.
- Also see section 3.3.

3.3 Management impacts on hazel

3.3.1 Browsing

Cattle had access to five sub-compartments, there was evidence for sheep in 20 sub-compartments and deer were probably present in at least 41 of the sites. There was no attempt to formally assess the general background browsing levels, but the browsing impacts on hazel were assessed (see section 3.2).

3.3.2 Cutting of hazel (including cropping by beaver).

Cutting of some individual hazel stems was recorded in 10 sub-compartments. Most of this was selective cutting by human activity (probably for sticks) but in one sub-compartment the stems had been cut by beaver.

At most sites cutting was limited to selective cutting of a few stems, but at a couple of sites the cutting was a more serious issue: whole stool coppicing was recorded as present in four sub-compartments. An additional three sites had some limited cutting for wayleaves/roadside cutting but it was not recorded whether this involved whole stool coppicing of mature hazels. The main issues regarding cutting were at two sites:

- At one site with cattle a number of hazels have been cut (including some whole coppiced stools) apparently to clear paths and feeding areas for cattle. The cut and whole coppiced stools are in poor condition, not regenerating due to browsing and some appear to be dying. Some of these hazels supported notable lichens including *Fuscopannaria sampaiana* (**NT NS BAP Sc IR**). This lichen was not commonly recorded during this project and was scarce in this particular sub-compartment so the coppicing of hazels supporting this species is a cause for concern.
- At another site beaver activity has had a negative impact on hazel stools. Some stems up to 20 cm dbh had been cut, and beavers had coppiced whole stools. The cut stems examined included well developed *Lobarion* and hyperoceanic *Graphidion* communities. *Lobarion* species on cut stems included *Lobaria pulmonaria*, *L. virens*, *Pannaria conoplea* (**IR**), *Sticta sylvatica* (**IR**) and the Hazel Gloves Project target species *Parmeliella testacea* (**NT NS BAP IR**). *Graphidion* species of interest on cut stems included *Arthonia ilicina* (IR), and three Hazel Gloves Project target species: *Pyrenula occidentalis* (**IR**), *Thelotrema petractoides* (IR) and *T. macrosporum* (**NS IR**). *Pseudocyphellaria norvegica* (**NS BAP Sc IR**, rare in this sub-compartment) was recorded c. 30 m upslope from the loch margin, on a hazel near the edge of in the area affected by beavers. Within three metres of this hazel are two other hazels that have been subject to beaver activity (though the damage was quite old and limited to small diameter stems). Browsing of basal regrowth (by deer and presumably beaver) is also an issue (see also Genney (2015) for further assessment of the impact of beaver on hazel in Mid Argyll).

3.4 Environmental data

3.4.1 Sub-compartment size

Forty-four sub-compartments were surveyed ranging in size from 0.5 to 11.1 ha, with an average size of 3.0 ha, and a median size of 1.6 ha. 77% of the sites were less than 4 ha (Figure 2).

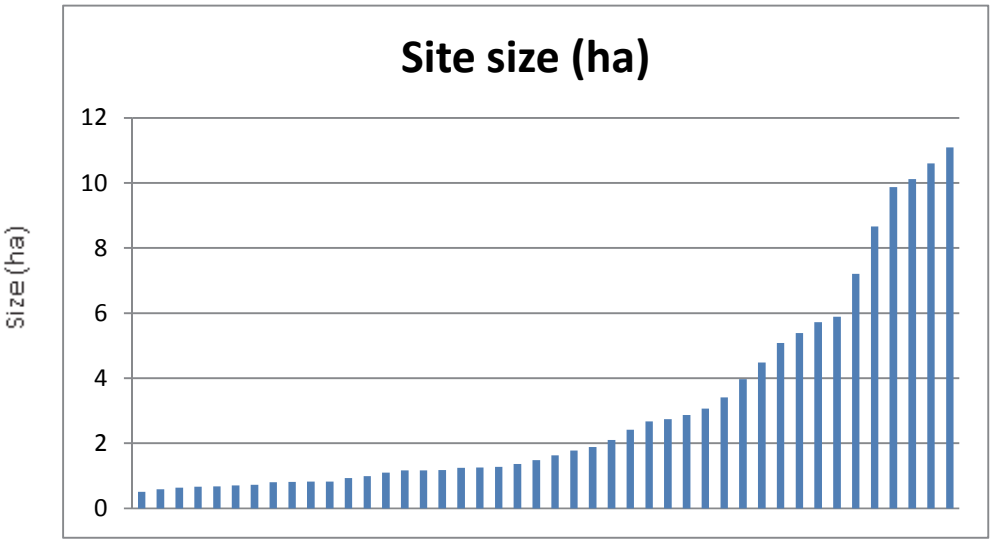

Figure 2. Size distribution of the 44 sub-compartments surveyed based on NWSS data

3.4.2 Percentage cover of hazel in sub-compartments

Eighty four percent of the sub-compartments (i.e. 37 of the sub-compartments) had a cover of 50% hazel or more, and 22% of the sites had a hazel cover of >85% (Table 2).

Table 2. Based on NWSS data for the surveyed sub-compartments.

% cover of hazel	Average % cover	Number of sites with this cover of hazel
30-45	40.7	7
50-65	51.6	17
70-80	76.5	10
85-100	93.5	10

There was often some discrepancy between the habitat as assessed by the surveyor and the habitat listed in the NWSS data.

The sub-compartments listed by the NWSS data as 'unidentifiable' were found to be pure hazelwood stands. The NWSS surveyor guidelines clearly need to be updated to recognise this as a specific type. This is especially important in western Scotland where hazelwoods are an internationally important habitat (e.g. Coppins & Coppins, 2012).

Sub-compartments identified as upland birchwoods in the NWSS data were assessed during this survey as several different types – some were stands of hazel-birch, some with hazel birch and oak. More worryingly, some were found to be predominantly hazel stands, and one was hazel-ash and one ash-elm (refer to Annex 3 for details).

Two of the upland mixed ashwoods were actually hazelwoods, again illustrating the need to recognise hazelwoods as a distinct woodland type. One of the sub-compartments listed by the NWSS as an upland oakwood was an ash-hazel woodland.

Some of the discrepancies between the NWSS dominant habitat and the habitat as assessed during the hazel gloves survey may be due to the fact that the dominant NWSS habitat may be a relatively low percentage cover of the sub-compartment (e.g. 40 %) but the above highlights the need to be wary of using the 'dominant habitat' from the NWSS data without also examining the rest of the dataset and, ideally, some ground truthing.

3.4.3 Distance from the coast

A number of the sites were coastal (the closest was only c. 30 m from the sea). Refer to survey data and maps in Appendices 4 and 5 for more details. There appeared to be no particular correlation between much of the survey data collected and proximity to the coast. Though it is worth noting that the Red Data Book (RDB) lichen *Sticta canariensis* (**VU NR BAP Sc IR**) was only recorded on coastal rocks and trees in one sub-compartment.

3.4.4 Soil pH in sub-compartments

The pH in sub-compartments ranged from 4.3 (very acid) to 6.7 (mildly acidic) with a median of 5.2 (acid) and an average pH of 5.3 (acid). These calculations discount one measurement of 3.8 in one peaty sample.

3.5 Assessment of lichen communities

The method developed to assess the lichen flora as part of this project gives some indication of the health and viability of the *Lobarion* community, *Graphidion* community and a range of target species at a site. Many of the target species are good indicators of a well-developed *Lobarion* community or *Graphidion* community so they form the basis of a method to rapidly assess how well developed the lichen flora is over a range of sites relative to each other. This provides a useful way to assess the heath of lichen populations at a range of sites in addition to calculating indices of ecological continuity (Coppins & Coppins, 2002). Additional target lichen species could be assessed if the lichen flora was the main focus of a study.

The number of sub-compartments with each of the target species is presented in Figure 3 (based on the data in Table 3). The graph and table also show the number of sub-compartments in which the target species is considered to have healthy/viable populations. The population of *Lobaria pulmonaria* is considered to be viable in a sub-compartment where the species is present on a minimum of 15 trees/shrubs (Scheidegger *et al.*, 1998). In this survey, given that some of the target species have a more restricted distribution than *Lobaria pulmonaria* (and therefore presumably colonise less readily than *L. pulmonaria*), a more conservative threshold of 25 trees has been adopted as a lower threshold for a population that is not only just at the lower threshold of viable but probably 'healthy'. More research is required to refine our understanding of lichen population viability, however the approach taken here provides a consistent approach based on available knowledge.

The most frequent *Lobarion* target species encountered were *Leptogium burgessii* (recorded in at 26 sub-compartments) and *Parmeliella testacea* (in 24 sub-compartments) but they are only viable at 12 and eight sites respectively (Figure 3). The only other target *Lobarion* species found on more than 25 trees/shrubs is *Leptogium brebissonii* (only viable at one sub-compartment). A number of notable target species are present at more than 5-20 sites, but as unviable populations (on <25 trees/shrubs). For example although the *Fuscopannaria sampaiana* is present in 11 sub-compartments it is scarce or rare in 10 of them and does not meet the threshold for long term viability (15 trees) in any.

The *Graphidion* target species with the largest (and therefore most viable) populations in Mid Argyll are *Pyrenula laevigata*, *P. occidentalis*, and *Thelotrema lepadinum*. *T. macrosporum* may be present and viable at more sites than indicated in this study as it is easily overlooked as poorly developed thalli of the more common *T. lepadinum* without close inspection (not always possible to do on a large number of trees during such a rapid survey). *T. petractoides* (one of the key hyperoceanic *Graphidion* target species) is genuinely much more local and although present in 14 sites was only healthy and viable at four sites.

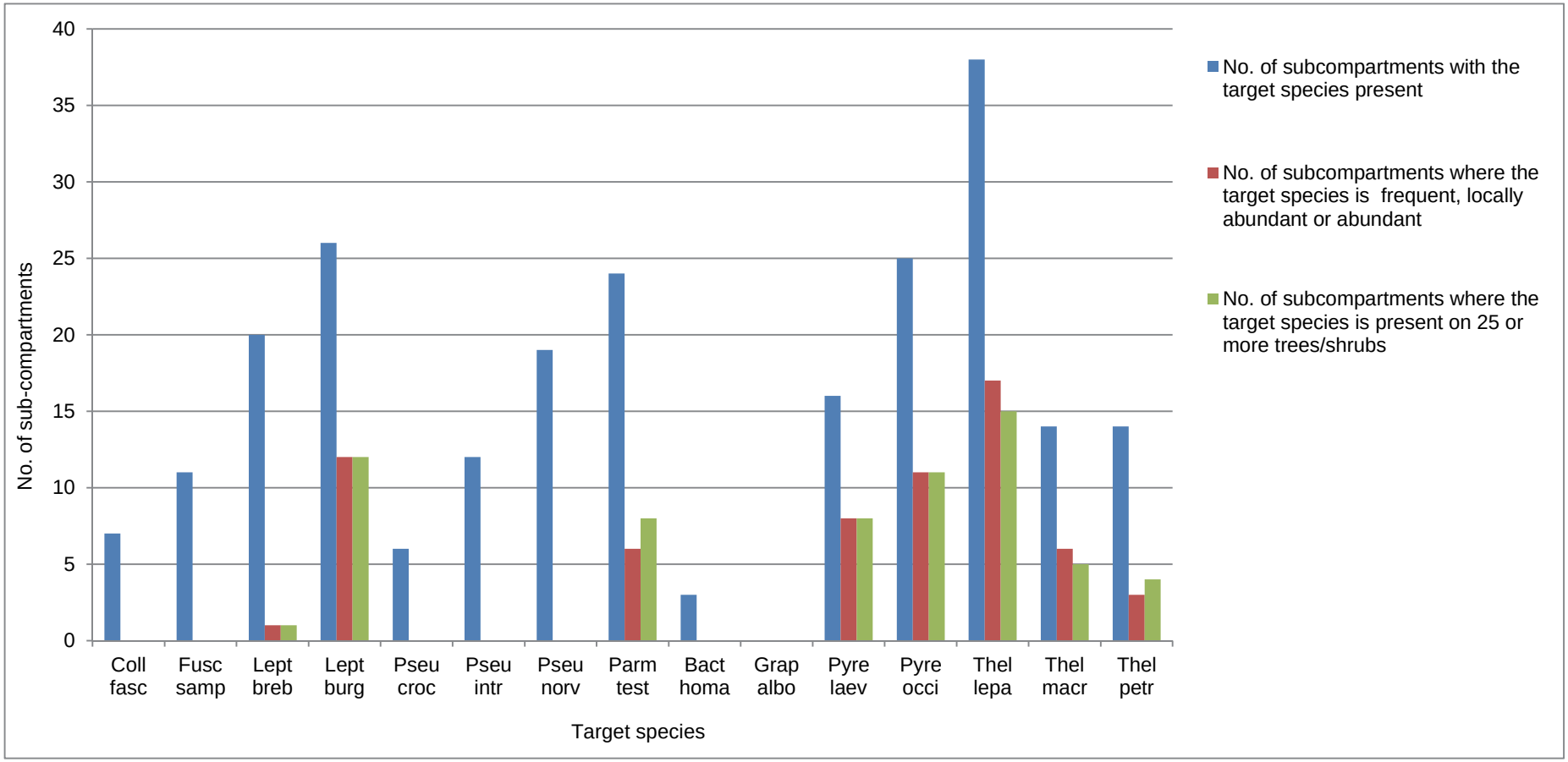

Figure 3. The graph shows that the healthiest populations of Lobarion target species in Mid Argyll are Leptogium burgessii (recorded in 26 sub-compartments) and Parmeliella testacea (in 24 sub-compartments). Leptogium brebissonii is present in 20 sub-compartments but appears to be only healthy and viable in one sub-compartment. Other Lobarion species are present on less than 25 trees/shrubs in all sub-compartments and so could be interpreted on the basis of this study as unviable populations. Further research would be needed to confirm this. The Graphidion target species with the healthiest populations in Mid Argyll are Pyrenula laevigata, P. occidentalis, and Thelotrema lepadinum with T. macrosporum and T. petractoides much more local.

Table 3. Note the frequency/abundance categories follow the guidelines in Annex 2.

Target species	**No. of sub-compartments with the target species is**					**No. of sub-compartments where the target species is present on 15 or more trees/shrubs**	**No. of sub-compartments where the target species is present on 25 or more trees/shrubs**
	Present	**Rare**	**Scarce**	**Occasional**	**Frequent, locally abundant or abundant**		
Collema fasciculare	7	4	3	0	0	0	0
Fuscopannaria sampaiana	11	7	3	1	0	0	0
Leptogium brebissonii	20	13	3	2	1	4	1
Leptogium burgessii	26	2	7	3	12	12	12
Pseudocyphellaria crocata	6	2	2	2	0	1	0
Pseudocyphellaria intricata	12	5	5	2	0	1	0
Pseudocyphellaria norvegica	19	7	10	1	0	1	0
Parmeliella testacea	24	5	6	3	6	10	8
Bactrospora homalotropa	3	3	0	0	0	0	0
Graphis alboscripta	0	0	0	0	0	0	0
Pyrenula laevigata	16	4	1	2	8	9	8
Pyrenula occidentalis	25	9	1	2	11	12	11
Thelotrema lepadinum	38	6	3	8	17	23	15
Thelotrema macrosporum	14	4	1	1	6	6	5
Thelotrema petractoides	14	2	5	1	3	6	4

4. DISCUSSION

The main aims of the project were to:

- Analyse field data to identify relationships and correlations between the attributes both physical and biological which are characteristic of woodlands where the hazel gloves fungus is known to occur.
- Identification of sites with potential for expansion/new planting/management which can be flagged up for inclusion under forthcoming land use strategies e.g. SRDP and FDP's

These outputs are discussed in sections 4.1 and 4.2. Additional aspects of the project are discussed in sections 4.3-4.4.5

4.1 Identifying characteristics of woodland where hazel gloves is known to occur

Only four locations for hazel gloves were known from Mid Argyll when the project started: one in Knapdale c. NR 8091, two at Carnassarie (both NM8400) and one at Drimfern (NN0814) (http://spreadsheets.google.com/pub?key=p_XD9kn_54bJVJQVAVDxELQ). Only one stromata of hazel gloves fungus was recorded on one hazel in one sub-compartment during the project. Both surveyors are very familiar with the hazel gloves fungus and it is possible that hazel gloves fungus is genuinely scarcer in Mid Argyll than North Argyll and the islands. Selecting some sites in North Argyll using the same method as in the Mid Argyll hazel project, then collecting the same environmental and biological data would be needed to be more confident that this is the case. There is still much potential hazel gloves habitat in Mid Argyll that remains unexplored so visiting additional sites might be worthwhile.

Insufficient records of hazel gloves were made during this project to enable the relationships between environmental/biological data collected during the project and the presence of hazel gloves to be examined. There was plenty of apparently suitable habitat. For example, all sub-compartments had a good cover of hazel (84% of the sub-compartments had a cover of 50% hazel or more, section 3.1.2) and all sub-compartments supported glue fungus, so there are clearly other factors to be taken into consideration.

Surveying hazel sub-compartments in North Argyll using the method outlined in this report might shed light on any correlation between environmental/biological data and the presence of hazel gloves fungus. This would also give good comparative data on the health and viability of the target lichen species (see section 4.4). A desk study examining the existing NWSS data for sites known to support hazel gloves might also be a useful exercise.

Surveying hazel sub-compartments where hazel gloves fungus has been recorded in recent years throughout Argyll (and perhaps further afield) would give a larger set of data to investigate the correlation between environmental/biological data and the presence of hazel gloves (whether or not the fungus was observed during the survey). This could then be compared with the results of this project. If the analysis revealed that a clear correlation between environmental/biological data and presence of Hazel Gloves fungus then it might be possible to identify the sites most likely to support hazel gloves. Ideally, several relatively brief visits, over a period of a year or more would be a useful follow up to check for presence of Hazel Gloves.

4.2 Sites requiring management

4.2.1 Browsing impacts

The study has identified a number of sites where browsing is too high and where a relaxation in browsing would be desirable to ensure continuity of hazel habitat, especially with regard to

the lichen flora (section 3.2). The fact that all sites are browsed to some degree, but only 14 sub-compartments (32%) have serious negative impacts in terms of continuity of the hazel habitat and/or ecological continuity for the *Graphidion* (section 3.2), gives hope that hazel stands can be maintained without the necessity for long term grazing exclusion. This approach does however, require a commitment to maintain appropriate levels of grazing/browsing, at least until appropriate levels of regeneration have successfully established. Monitoring the impact of browsing on hazel dynamics is crucial to guide management. As a minimum this should involve the use of the Hazel Assessment Tables (Coppins & Coppins, 2012). Of more concern at some sites is the fact that hazel regeneration by seed is largely suppressed (section 3.2) and significant levels of regeneration have only established (>1.5 m) in four sub-compartments (9%). This is not necessarily an issue for the fate of the individual sub-compartments themselves where vegetative regeneration is often more important to maintain hazel stands (at least in the short to medium term). However, where there has clearly been recent loss of hazel habitat or where it is desirable to expand sites, it is likely that some serious reduction in browsing level will be required (and this may include temporary exclosure). Impressive levels of regeneration have been accomplished at Creagan in North Argyll, but in most areas the hazel has generally established well only when in close association with birch thickets (Acton, 2013). A few of the sites visited during the hazel project were assessed as birch-hazel stands and this would be an appropriate way to establish birch-hazel regeneration. However, at most of the sub-compartments visited birch is a minor component of the woodland and in most cases it would not be appropriate to allow birch thickets to establish to act as a nurse for hazel regeneration. The challenge here is to establish hazel, without fundamentally altering the composition of the stands. This is potentially a serious issue for pure hazel stands.

Baseline monitoring at Creagan was set up to look at the impact of browsing on glade maintenance for lichens and was funded through SRDP but there was no funding for long term monitoring of the birch-hazel thickets. Long-term monitoring of sites such as Creagan would enable the likely fate of these birch-hazel thickets in the long term to be assessed (Acton, 2013). Any changes to management instigated as a result of the hazel project should be monitored to check the management regime has the desired effect.

4.2.2 Hazel cutting/coppicing

Selective cutting is occasional (recorded as present in 10 sub-compartments, in one of these due to beaver activity). It was scarce in most sub-compartments and human activity is unlikely to have any significant impact on the hazel habitat or epiphytic lichen flora. Whole stool cutting was most common along wayleaves (generally limited to cutting young hazel) and for roadside maintenance (where it can include old hazels, pers. obs.). Whole stool cutting away from wayleaves and roadsides is rare (section 3.3.2), but where it does occur it could potentially have a significant impact on the hazel habitat and associated lichen flora.

4.3 Sites with potential for expansion

The Hazel Gloves Project has identified a number of sites where there is potential for expansion of the hazel habitat from the sub-compartment onto adjacent ground. Only six sites (14%) were considered to be unsuitable for expansion whilst 38 sites (86%) have some potential for expansion. Twenty one sites (48%) were assessed as having particularly good potential for expansion. Expansion will in many cases increase the available habitat within the vicinity of the sub-compartment and, if this can be achieved in a manner compatible with the lichen interest (e.g. avoiding long term exclusion of all browsing), it will increase available habitat for epiphytic lichens (a key biodiversity feature of hazel in Argyll). The impact of any changes in management should be monitored. As a minimum this should be done using the

Hazel Assessment Tables (HATs) in Coppins & Coppins, (2012) but ideally an ecologist familiar with lichens of Atlantic hazel should be involved.

During the survey work it was found that many of the hazel stands are isolated fragments and this has implications for the associated biodiversity interest. It is well known that species associated with isolated and fragmentary habitats are more prone to local extinctions. Given the small lichen populations of target species in many sub-compartments (in many cases possibly 'unviable' – see section 4.4), the fragmented nature of the habitat is a cause for concern so some sensitive restoration of habitat networks would be welcomed. Possible networks are readily inferred from a brief examination of the survey maps (Annex 4). The sub-compartments with potential for expansion are shown in these maps to facilitate planning of any restoration networks. NWSS data should be consulted to examine the composition of other native woodland types between the hazel sub-compartments. Two good obvious candidates for landscape scale restoration of hazel are in the vicinity of Garraron-Lergychioniemore-Lergychoniebeag-Barbreck River (Figure 4) and Carnassarie-Loch Ederline (Figure 5). There are also good opportunities in Knapdale for restoration of hazel stands associated with Plantations on Ancients Woodland Sites (PAWS). Increasing the available hazel habitat might be prudent given the negative impact beavers are having on some of the habitat along loch shores (Acton, 2013). If the trial is extended or beavers are allowed to establish on a more permanent basis, the long term impact would hopefully be offset by increasing the available habitat resource.

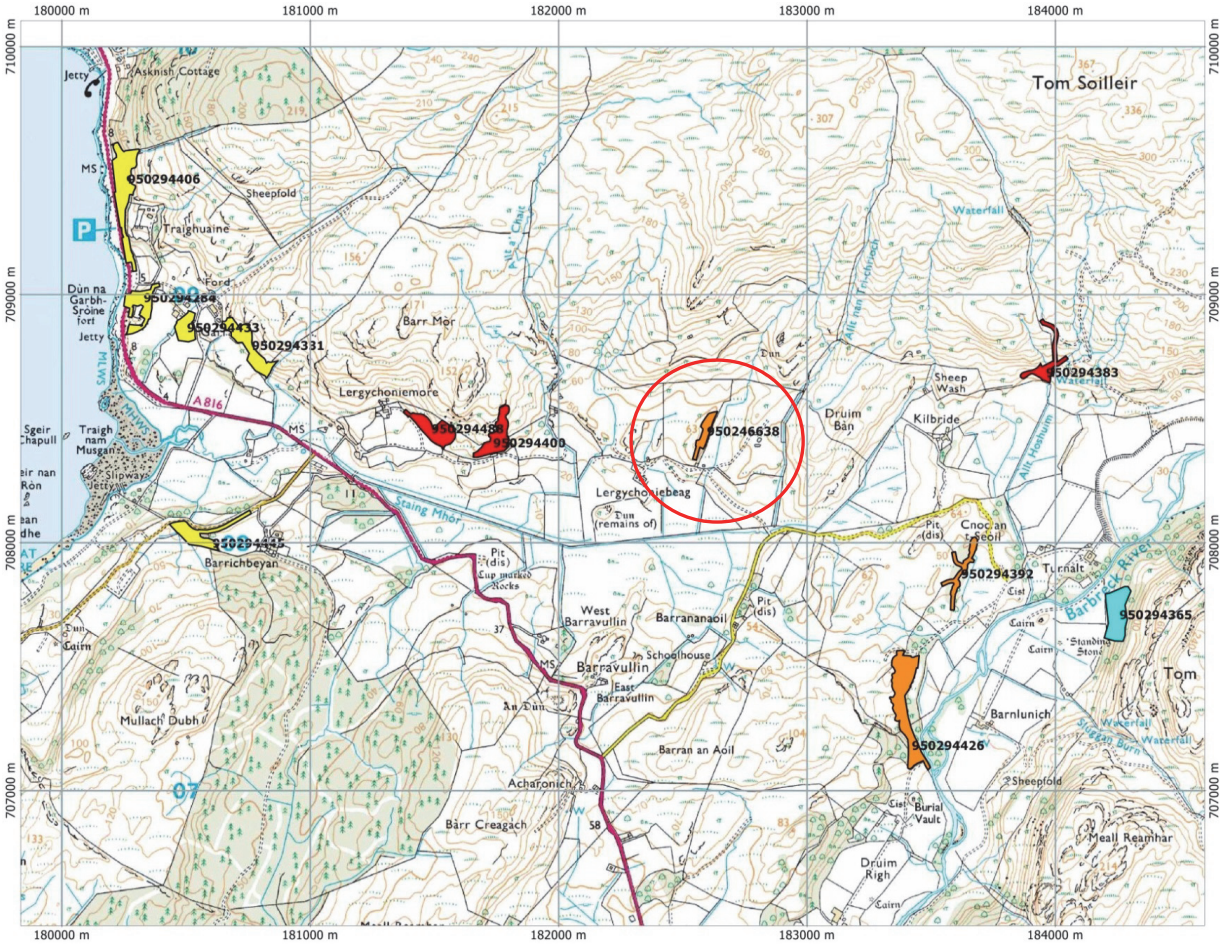

Figure 4. An area with excellent potential for landscape scale restoration of hazel rich woodland. Hazel stands identified during this project are indicated by the polygons labelled with sub-compartment numbers. Yellow sub-compartments were not visited; orange polygons have potential for expansion; red polygons have excellent potential for expansion. The blue polygon is a good hazel stand with well-developed Graphidion and Lobarion communities but woodland expansion potential was limited because the adjacent ground was already native woodland. The blue areas and any other existing native woodland would be important components of any proposed habitat network. Hazel gloves fungus was recorded in sub-compartment 950246638 (circled in red). (© Crown copyright and database right 2011. Ordnance Survey 100017908)

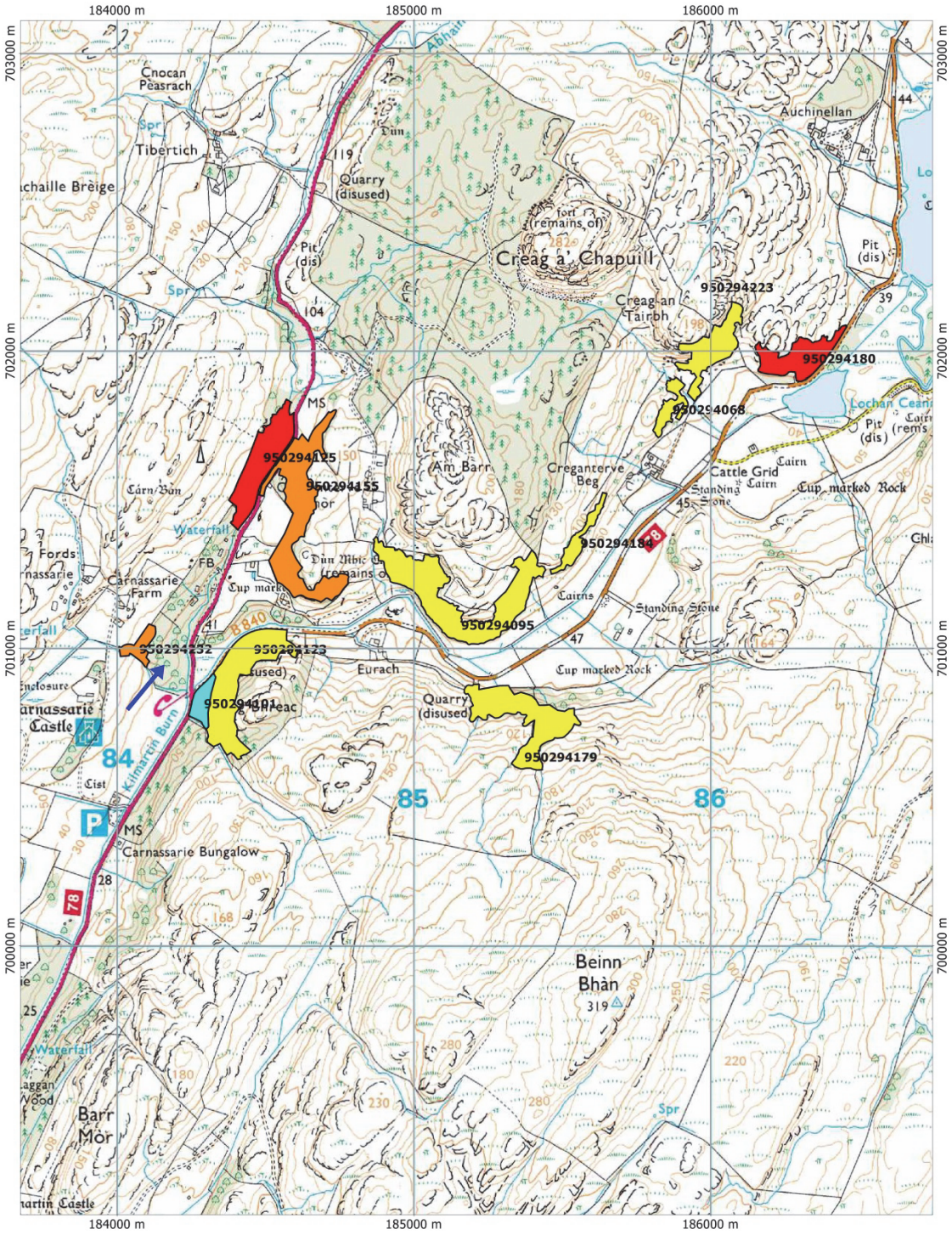

Figure 5. Another area with excellent potential for hazel rich woodland restoration. Note the woodland remnants and bracken slopes south to Barr Mor and beyond to Kilmartin would also have supported hazel rich woodlands in the past (pers. obs.) and would be good to include in any proposed restoration project. Consideration should also be given to PAWS restoration. For example connecting up hazel remnants separated by the conifer plantations at Carnassarie (hazel gloves has been previously reported from a hazel stand not included in any sub-compartment but indicated by the blue arrow on this map). The conifers on the steep slopes northeast of Carnassarie Bungalow would also be a good candidate for PAWs restoration. (© Crown copyright and database right 2011. Ordnance Survey 100017908)

4.4 Lichens in the sub-compartments

The data appears to suggest that the populations of many of the target species are poor and possibly unviable at many of the sub-compartments visited, probably at risk of local extinction, and therefore could benefit from measures to improve habitat condition and increase the available suitable habitat. The *Lobarion* and *Graphidion* communities in Argyll support species that are of international importance and hazel is of prime importance for those communities. Therefore the lichens of hazel should certainly be considered a priority when dealing with planning applications and implementing conservation measures.

Long term monitoring of sub-compartments would be needed to confirm whether the thresholds for health/viability of lichen populations adopted for this survey are appropriate. In addition, although many species within these lichen communities are considered poor dispersers, we do not know how far individual lichen species propagules disperse and therefore what constitutes an isolated population for each species. Work is currently underway in Glen Creran to quantify dispersal distance for a range of oceanic epiphytic lichens (Sally Eaton, RBGE pers. comm.). Comparative studies to the survey described here, in North Argyll (where the populations of a number of the target species are expected to be healthier) and Lochaber, would also be desirable.

Preliminary assessment of the condition of hazel stands can be done by non-specialists using the Hazel Assessment Tables (Coppins & Coppins, 2012). The method developed for the Hazel Gloves Project could provide a useful and relatively quick way to help prioritise sites for conservation management as it assesses the health and viability of hazel stands and also the health of the associated lichen flora by looking at the health and viability of a number of associated target lichen species. Ideally (though this would often require more fieldwork) the Indices of Ecological Continuity (Coppins & Coppins, 2002) would be utilised in conjunction with the above method. The Indices assess the conservation importance of the epiphytic lichen flora based on the presence of a range of 'old woodland' indicator species (they do not require measurement of frequency/abundance of species).

The lists of lichen taxa recorded during the survey will be submitted to the Scottish Sites Lichen Database (SSLD) for upload to the National Biodiversity Network and will be available at http://data.nbn.org.uk/. The fieldwork recorded a number of important lichen records of species that are scarce, rare and/or threatened in Argyll. The most interesting lichen records were: *Gomphillus calycioides* (NT NS BAP Sc IR, scarce in Mid Argyll but not uncommon in North Argyll), *Leptogium coralloideum* (VU DD NR Sc IR), *Porina rosei* (NT NS IR), *Pseudocyphellaria lacerata* (VU NR BAP Sc IR) and *Sticta canariensis* (VU NR BAP Sc IR).

4.5 Other considerations

The NWSS is a fantastic resource and it would have been be very difficult to find a good selection of sites otherwise. However care should be taken when utilising some of the NWSS data. For example, be wary of using NWSS woodland structure class data to assess condition of hazel stands without ground truthing. The NWSS field survey protocol (FCS, 2010) acknowledges 'specific guidance is not available from SNH on DBH thresholds for Aspen, Hawthorn, Hazel and Holly'.

The project also highlights that more or less pure hazel stands have not been given full recognition by the NWSS being variously described as 'unidentified habitat', upland mixed ashwood, or even upland birchwood. It would be useful for the guidance for any follow up NWSS surveys to be revised to take into account more or less pure hazelwoods in order to try to quantify the extent of this internationally important habitat. A desk study should be able to extract candidate sites from the NWSS stocking data for hazel (e.g. see section 3.1.2) but it is likely that this would need some ground truthing.

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ANNEX 1: MEASURING SOIL pH

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Version V1.0

Updated 19 October 2012

What is soil pH?

Soil pH is the measure of the hydrogen-ion activity in the soil solution and is one of the most useful 'spot tests' that can be carried out in environmental studies. This is especially the case in attempting to relate the occurrence of native plant and animal species to environmental conditions. Soil pH is the negative logarithm of the hydrogen ion concentration in the soil solution ($pH = \log (1/H^+)$). A pH test measurement will vary from 0 to 14. An acid soil has a pH value below 7.0, rarely dropping below 3 except in peat soils. Above pH 7.0, the soil is alkaline, with soil pH above 10 only found in alkali soil of arid areas. Most agriculture soils in Scotland will have a pH value between 5 and 7.

Soil pH in Scotland's topsoils display a bimodal distribution peaking at 4.0 and 6.0, respectively (Figure 1). It is correlated strongly with organic matter content and also reflects the chemical imprint of the underlying geological substrate.

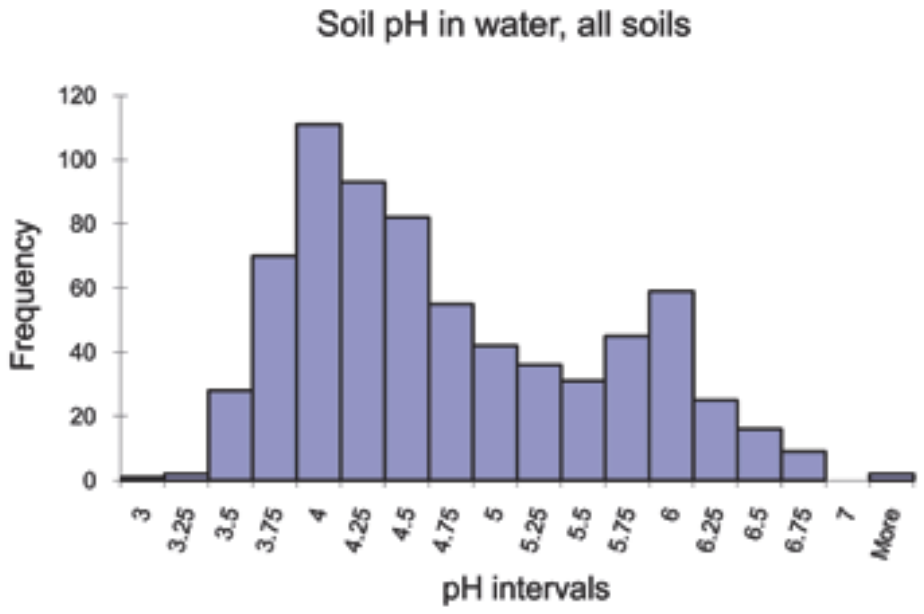

Figure 1. Distribution of soil pH in topsoils of Scotland (707 samples points) (adapted from Paterson et al, 2011)

Table 1. Range of soil pH and associated characteristics

pH range	Soil characteristics	
<5.0	Very acid	Most plant nutrients, particularly calcium, potassium, magnesium and copper, become more soluble under very acid conditions and are easily washed away Most phosphates are locked up and unavailable to plants below pH 5.1, although some acid tolerant plants can utilise aluminium phosphate Acid sandy soils are often deficient in trace elements Turnover of organic matter significantly reduces below pH 4.7 resulting in fewer nutrients being available to plants
5 to 6	Acid soil	Optimal conditions for major soil nutrient availability and bacterial and earthworm activity.
6 to 7	Moderately Acid soil	
>7	Moderately alkaline to very alkaline	Phosphorus availability decreases, iron and manganese become less available leading to lime-induced chlorosis.

Soil pH measurements are made in the soil-water slurries using deionised water or more specialist methods using dilute salt solutions (CaCl2, KCl, NaF). The use of CaCl2 solution instead of distilled water reduces ionisation which can suppress seasonal differences in pH within a soil. The method employing distilled water alone is widely used in soil science. It has the advantage of simplicity and it is designed to be used by people with limited access to a laboratory.

The ratio of water to soil is of some importance because the pH value obtained rises progressively as the proportion of water to soil is increased regardless of the initial pH value of the soil. Nevertheless, within limits, the effect of variations in water to soil ratio can be ignored if the same protocol is repeated.

How to use the SNH Pocket soil pH tester?

Check that your SNH pocket soil pH tester pack is complete. This should include:

- One Pocket soil PH tester probe
- 1 bottle of pH 4.0 buffer solution
- 1 bottle of pH 7.0 buffer solution
- 1 bottle of pH storage solution
- 1 set of 6 wide open mouth plastic bottles (note nalgene or LDPE plastic to be used to minimize risk of chemical leaching from bottle)

Additional materials needed include:

- De-ionised water (De-ionised water is available from DIY or car equipment suppliers and sold as battery water or steam iron water)
- Clean water (tap water low chemical content, use bottle water if local water is 'peaty')
- Trowel / spade / sampling knife
- Polythene or paper bags
- Marker pens and note book to record result

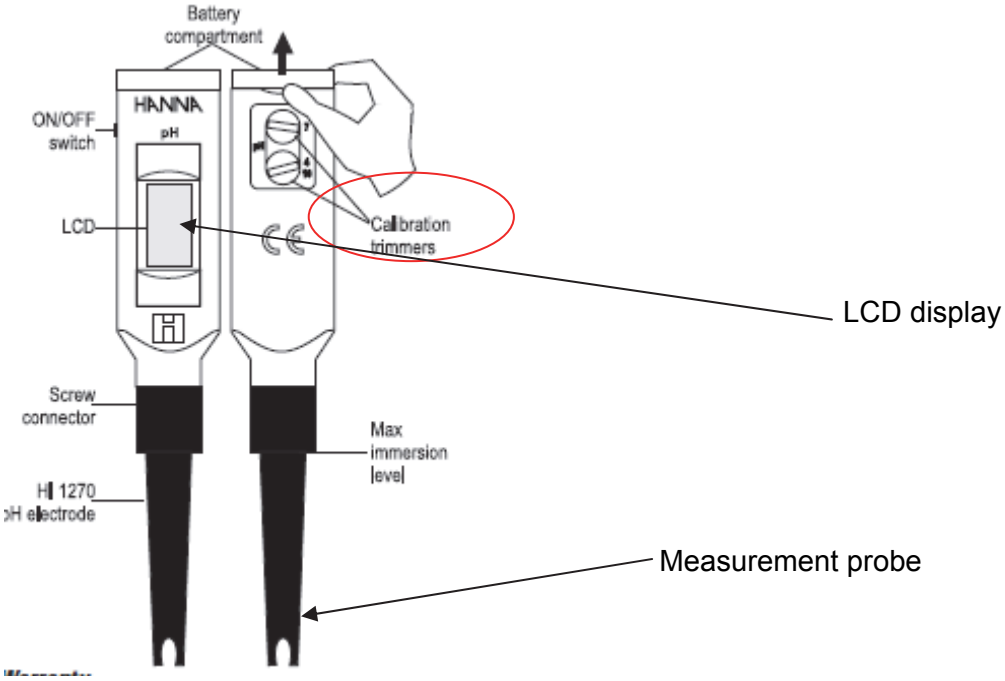

Figure 2. The pocket soil pH tester used - a Hanna HI 99104

AVOID TOUCHING THE TIP OF THE PROBE AS THIS MAY LEAVE GREASY DIRT ON THE SENSOR.

USE DE-IONISED WATER TO CLEAN THE PROBE TIP

NEVER LET THE TIP OF THE PROBE DRY OUT. (If this happen, dip the probe for at least 30 min in storage solution before use)

KEEP THE PROBE TIP WET - COVER WITH CAP AND STORAGE SOLUTION

Calibrating and maintaining the soil pH tester

The Pocket soil pH tester will require daily calibration when in regular use. Otherwise, the cap covering the probe tip needs to be checked at regular intervals and kept filled with a few drops of the pH storage solution provided in the tester pack.

The calibration of the meter is done using control buffer solution pH 4.0 and pH 7.0 provided in the tester pack. The calibration is best conducted in lab-like condition (clean and dry) not in the field.

Step 1 Remove the protection cap at the tip of the probe and clean and rinse the pH meter probe with de-ionised water.

Step 2 Immerse the tip of meter in pH7 buffer (HI7007), stir gently, allow the reading to stabilize and adjust the pH7.0 trimmer to read "7.0" pH.

Step 3 Rinse and immerse the electrode in pH4.0 buffer (HI7004), stir gently, allow the reading to stabilize and adjust the pH4 trimmer to read "4.0" pH.

If your buffer solution has been spoilt your pH result will be off. Keep your buffer solution clean and avoid extremes of temperature.

Soil sampling

You should always follow the agreed sampling methodology. For example for top soil measurement you may be required to collect a trowel size of soil at given depth below surface at regular point along field walk pattern (W or X shape). Each individual point can be analysed individually (to assess site variation) or the samples can be bulked for a single measurement representative of the sites. Please note to get a representative bulk sample in an enclosed site you must avoid sampling near the edge of the site or close to features likely to have disturbed the surrounding soils.

In any case, soil collected must be clear of stones and lumps should be gently broken down before being taken for analysis.

The recommended method for sample and analysis is the Method 2 - laboratory method using 1:1 soil water ratio and a settlement time of 30 minutes. This method 1 (field method) is faster but reading are more sensitive to variation in timing or measurement and soil:water mixing.

Method 1- Field pH measurement – soil pH in water

Soil pH is measured in the soil:water slurry using a 1:5 soil to water ratio.

Step 1 Fill the container with 50ml of deionised water and add 10g of soil (equivalent to 1 small heaped teaspoon of soil) taken from the bulk sample.

Step 2 Close the cap and shake the container for about 1-2 minutes then allow the soil to settle for 10 minutes.

Step 3 Prepare to log your test result in your data book for later reference. Result should be recorded to the 1st decimal place precision only.

Step 4 Remove the cap of the bottle and rinse the pH tester probe in de-ionised water and gently dip it in the bottle so that the tip of the probe is fully cover by the soil:water slurry, but the end of the tip does not touch the bottom of the sample (to avoid grit damage of the sensor). Turn the tester on. Take the reading when it stabilizes.

Step 5 Clean the probe with de-ionised water (avoid tap water) and repeat the measurement if in reading is in doubt.

Step 6 Empty the container, and clean it with clean water then rinse it with de-ionised water.

After use of the pH tester, the black cap should be put back on the tip of the tests with a few drop of storage solution to keep it moist.

Repeat measurement if in doubt about the reading, rinsing the tip of the probe between readings.

Method 2 - Laboratory pH measurement – soil pH in water (also showing soil pH in calcium chloride $CaCl_2$ lab only method)

Alternatively, soil pH measurement may be done in the control setting (lab or kitchen bench) as this will provide more robust result. The methodology is different. This uses a 1:1 soil to water ratio and require the soil sample to be bagged and brought back to the 'lab' for analysis.

Step 1 Fill the container with 20ml of deionised water and add 20 gram of soil (1 tablespoon of soil) taken from the bulk sample.

Step 2 Close the cap and shake the container for about 2-3 minutes then allow the soil to settle for 30 minutes shaking the sample several time more.

Proceed as from step 3 above for soil pH in water.

Step 1 Fill the container with 20ml of 0.01M CaCl2 solution and add 20 gram of soil (1 table spoon of soil) taken from the bulk sample.

Step 2 Close the cap and shake the container for about 2-3 minutes then allow the soil to settle for 30 minutes shaking the sample several time more.

Proceed as from step 3 above for soil pH in water.

After using the pH tester, the black cap should be put back on the tip of the tester with a few drop of storage solution to keep it moist.

Further reading:

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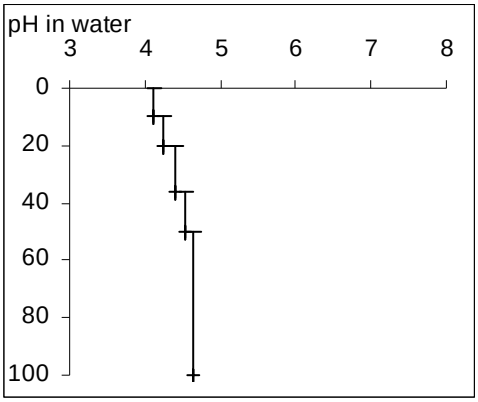
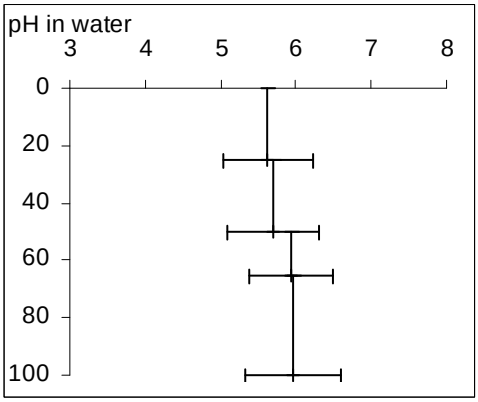
Hanna HI 99104 pH tester:manual. Available at: http://www.hannainst.com/manuals/manHI_99104.pdf

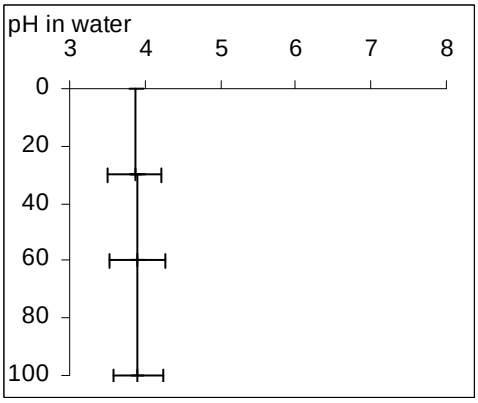
Example of average soil pH profiles for some typical soil types in Scotland



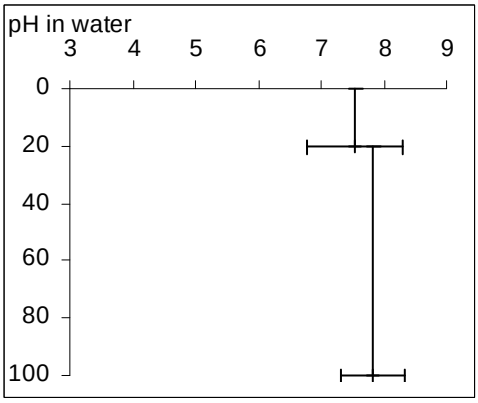
Torridon soil series Humic Gley



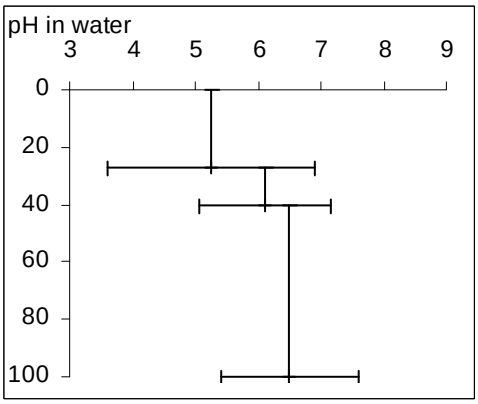
Darleith soil series Brown earth (cultivated)



Blanket peat



Frasenburgh soil series (dunes soils)



Deecastle soil series (limestone substrate)

Figure 3. Example soil pH profiles. The Y-axis represents the soil depth in centimetres. Each vertical bar shows the average pH value in a soil horizon. The horizontal bar at the bottom of the each vertical value shows the standard error of the mean for the associated horizon above.

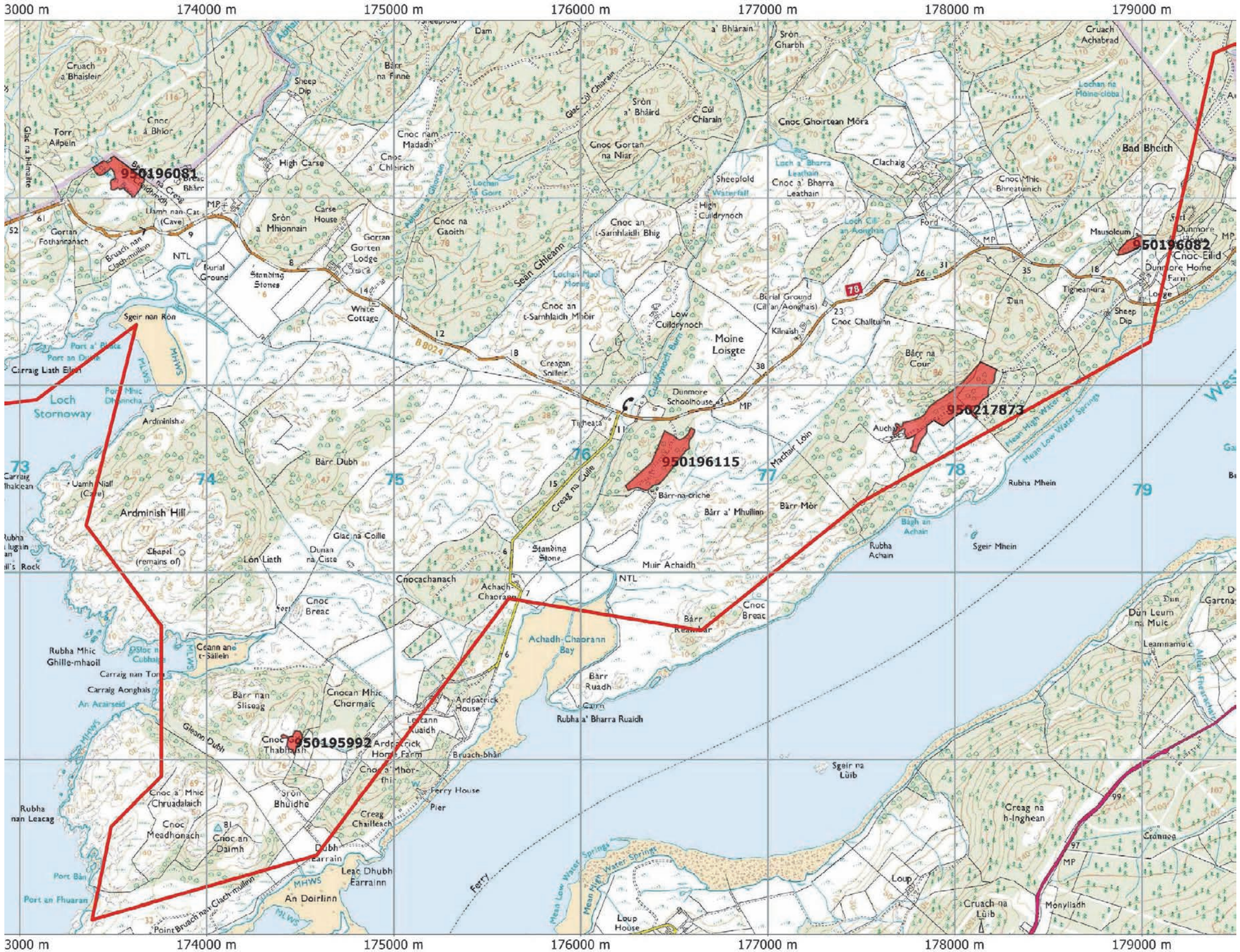
ANNEX 2: RECORDING GUIDELINES AND FORMS

This annex can be downloaded from SNH website as separate file.

ANNEX 3: RESULTS: COMPLETED RECORDING FORMS

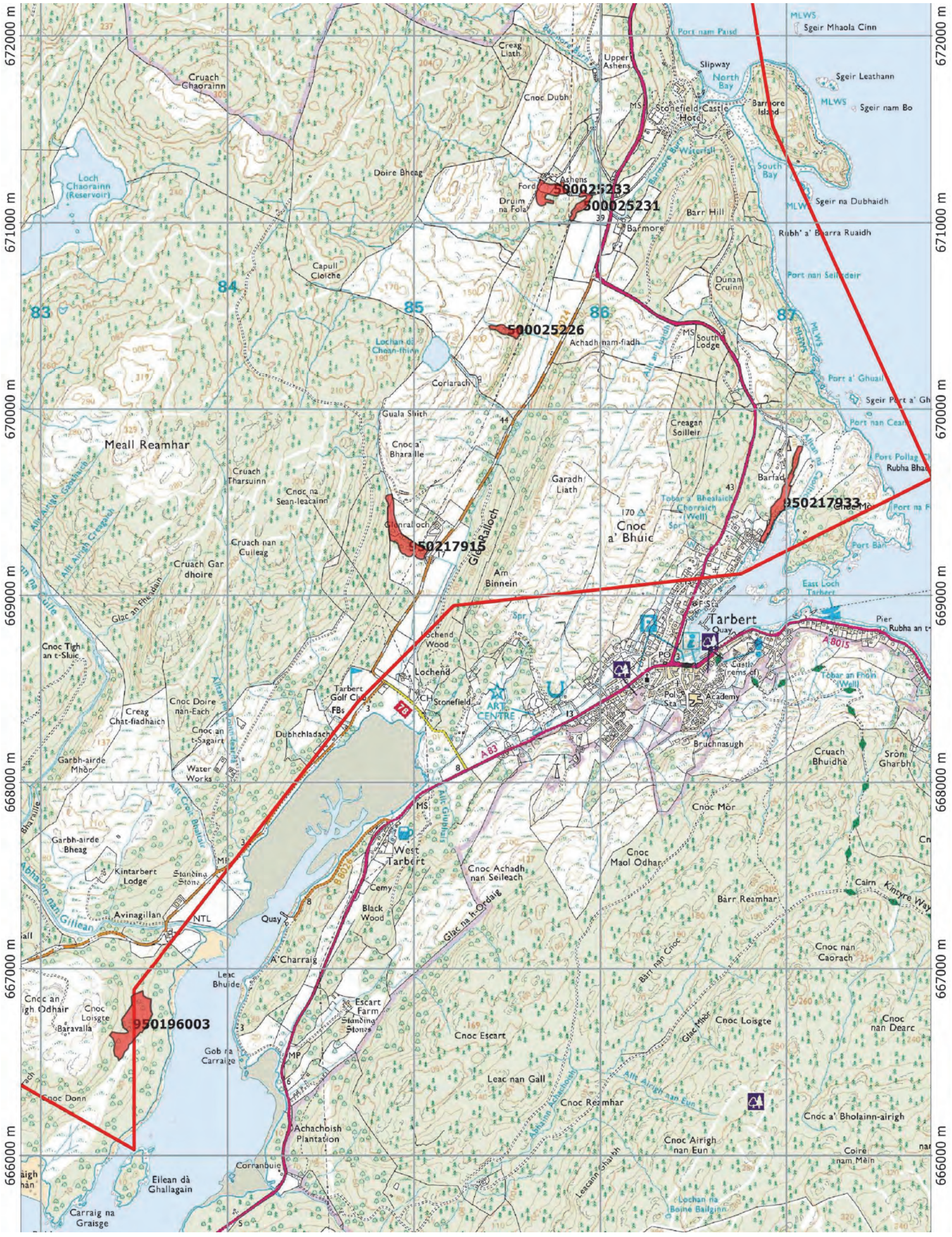
This annex can be downloaded from SNH website as separate file.

ANNEX 4: MAPS OF HAZEL-RICH SURVEY SUB-COMPARTMENTS

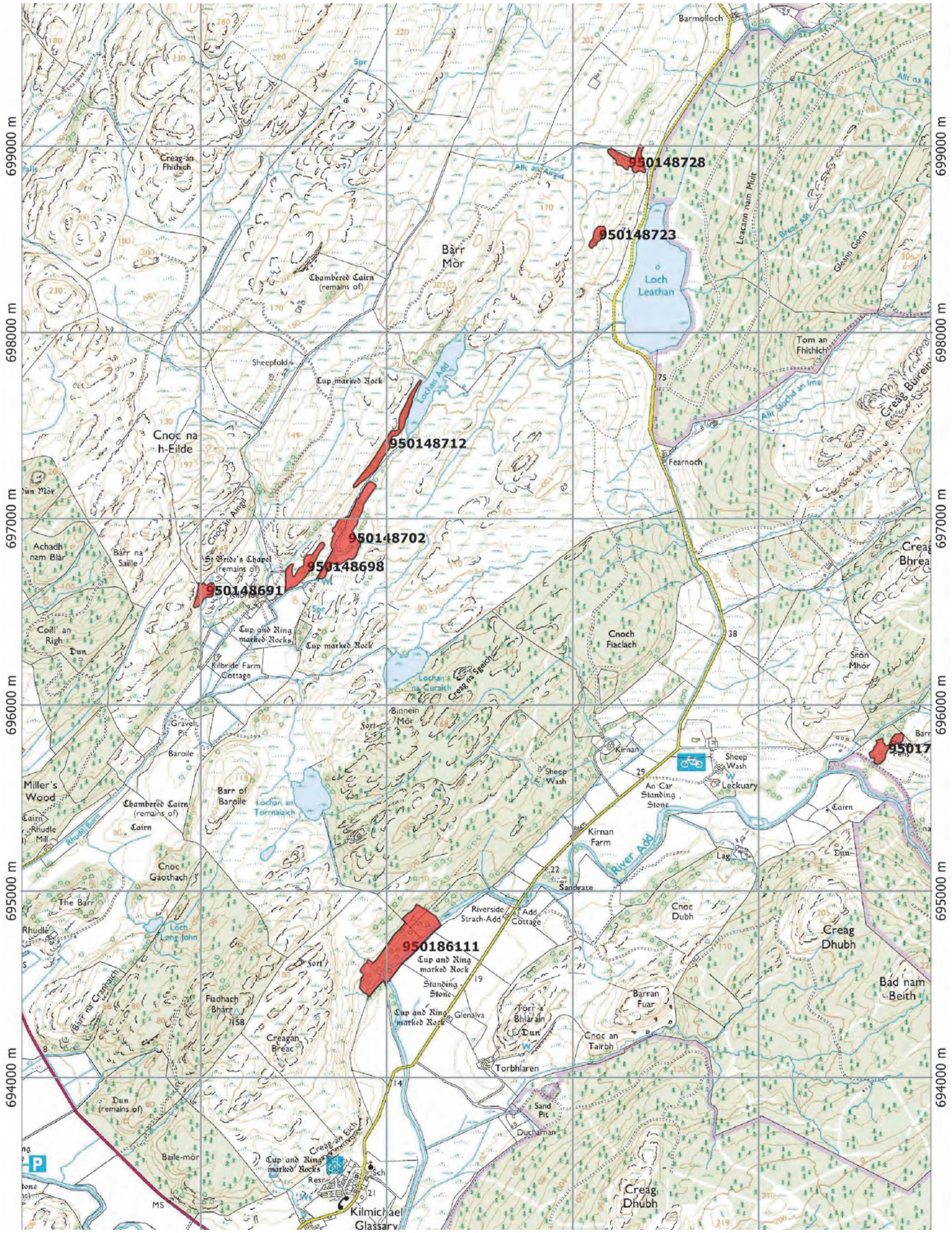


Map 1. West Loch, Tarbert south

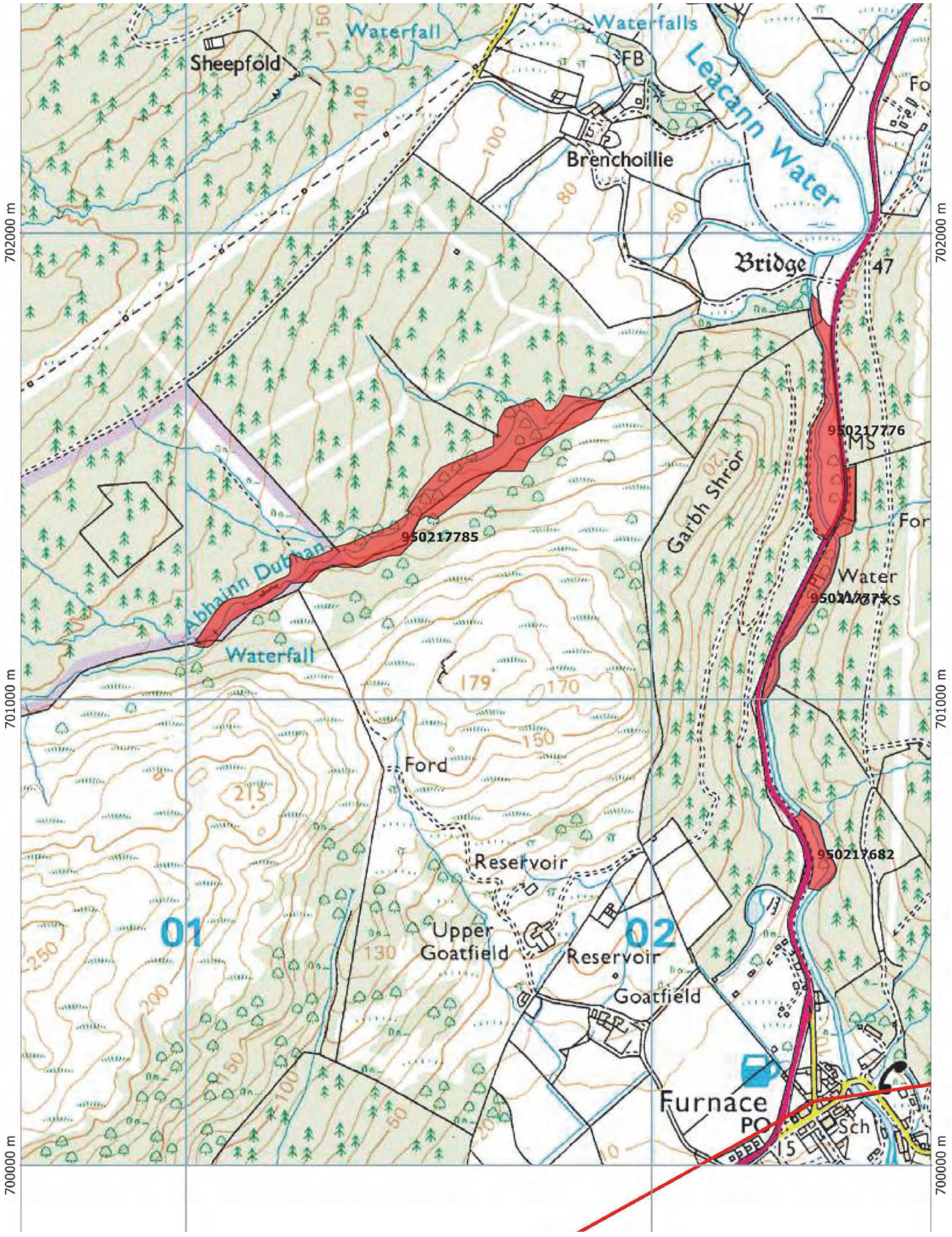
Map 2. West Loch, Tarbert north



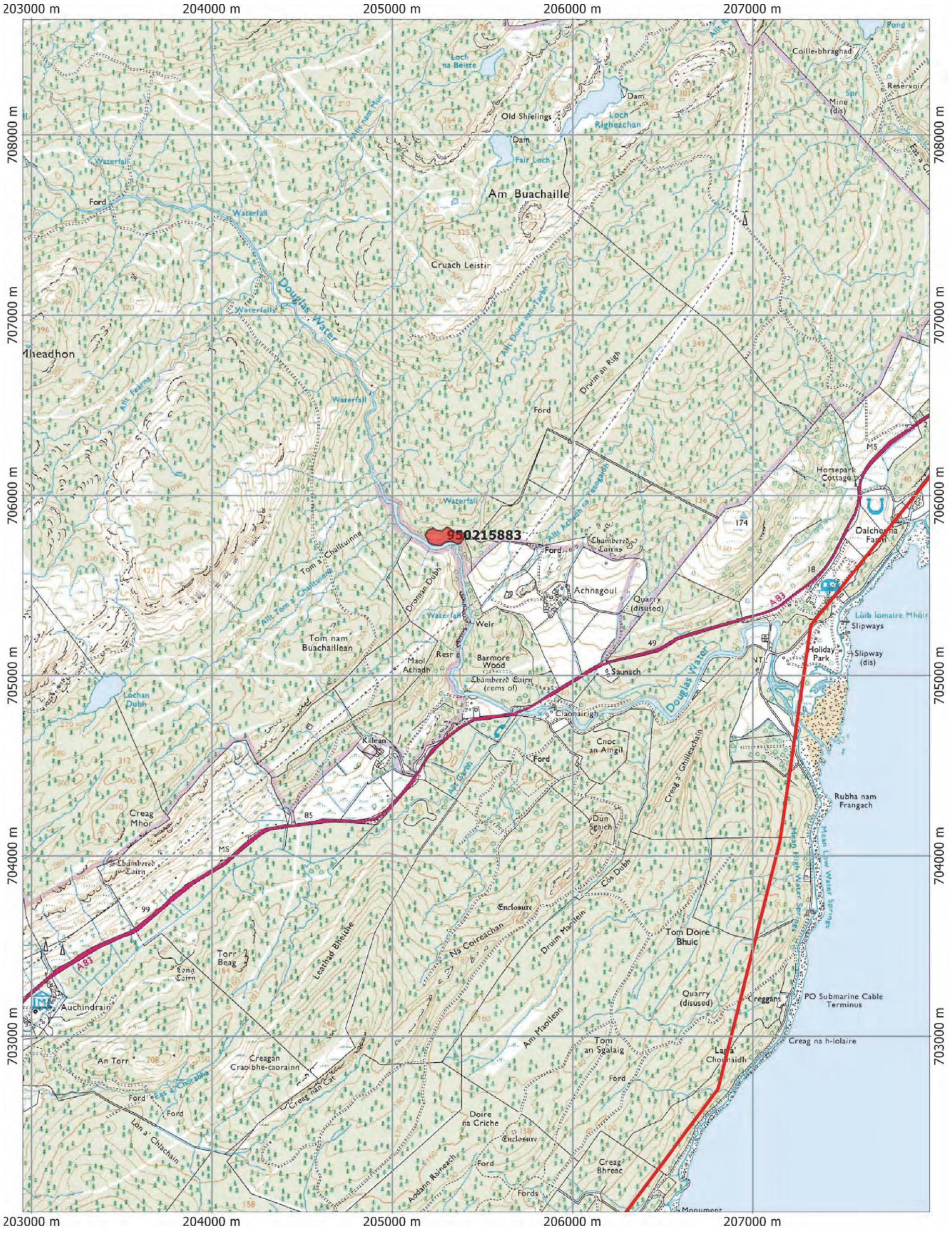
Map 3. Tarbert



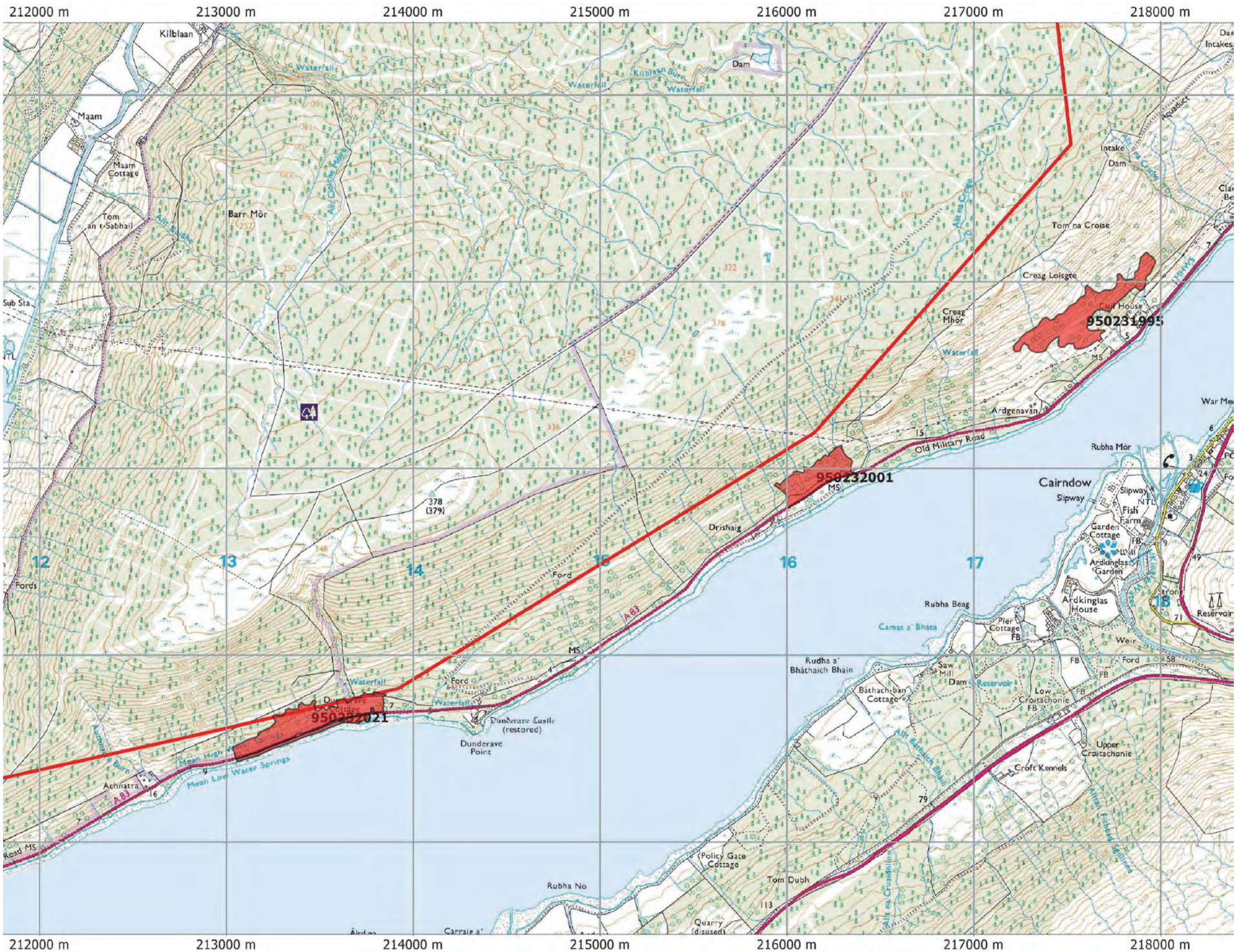
Map 4. Kilmiachael Glassary, Kilbride and Lochan Add



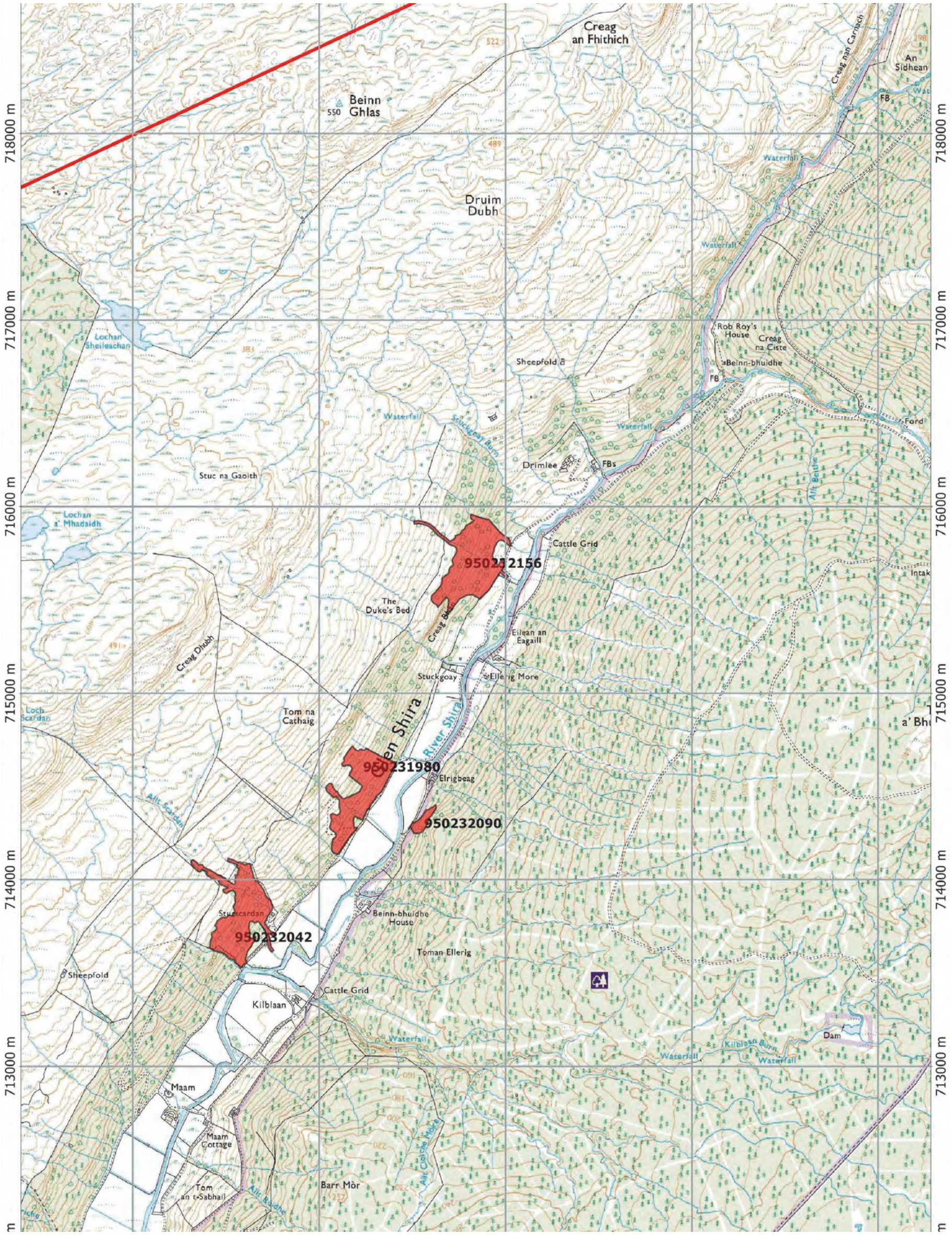
Map 5. Furnace



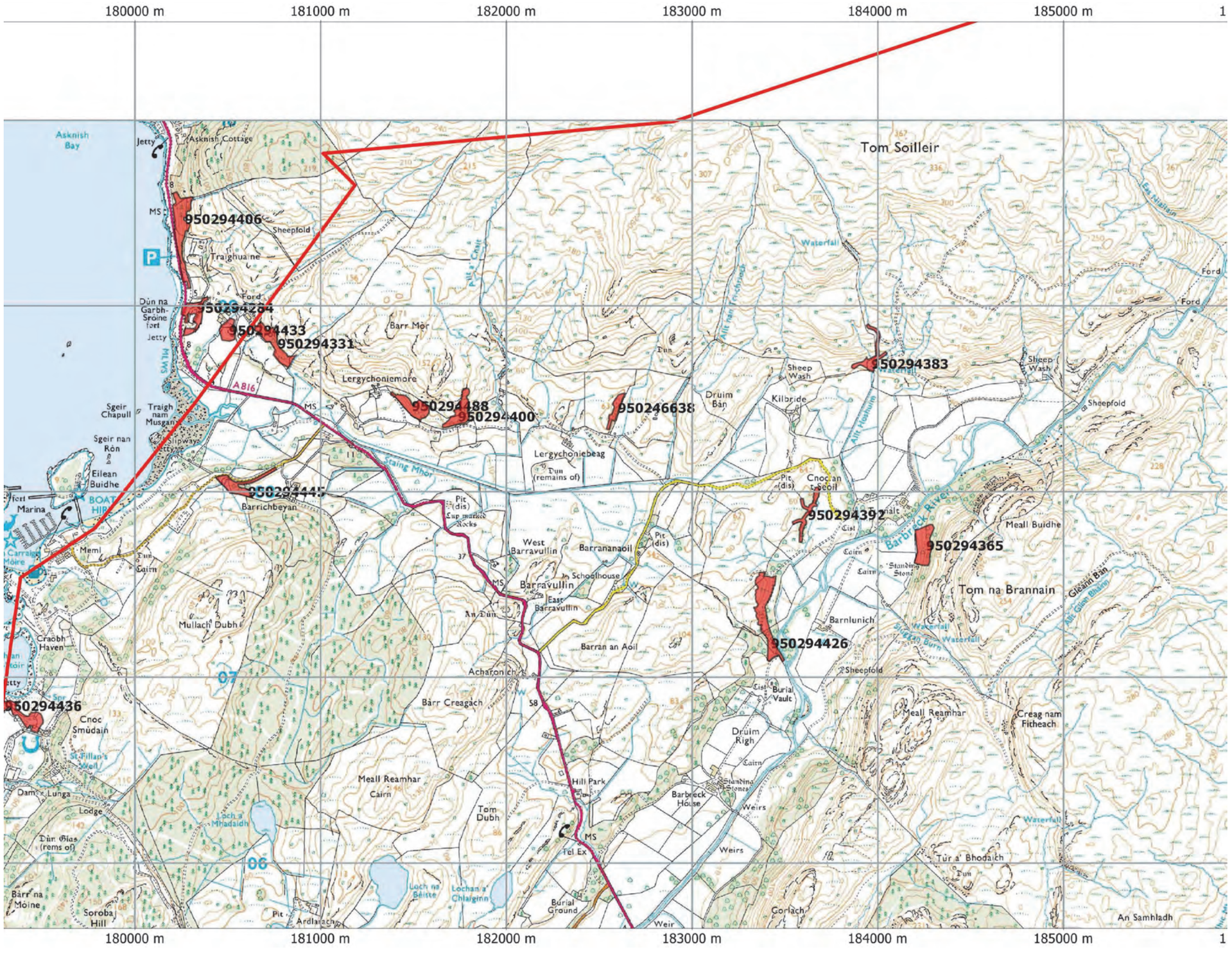
Map 6. West of Inveraray



Map 7. Achnatra to Clachan Beag

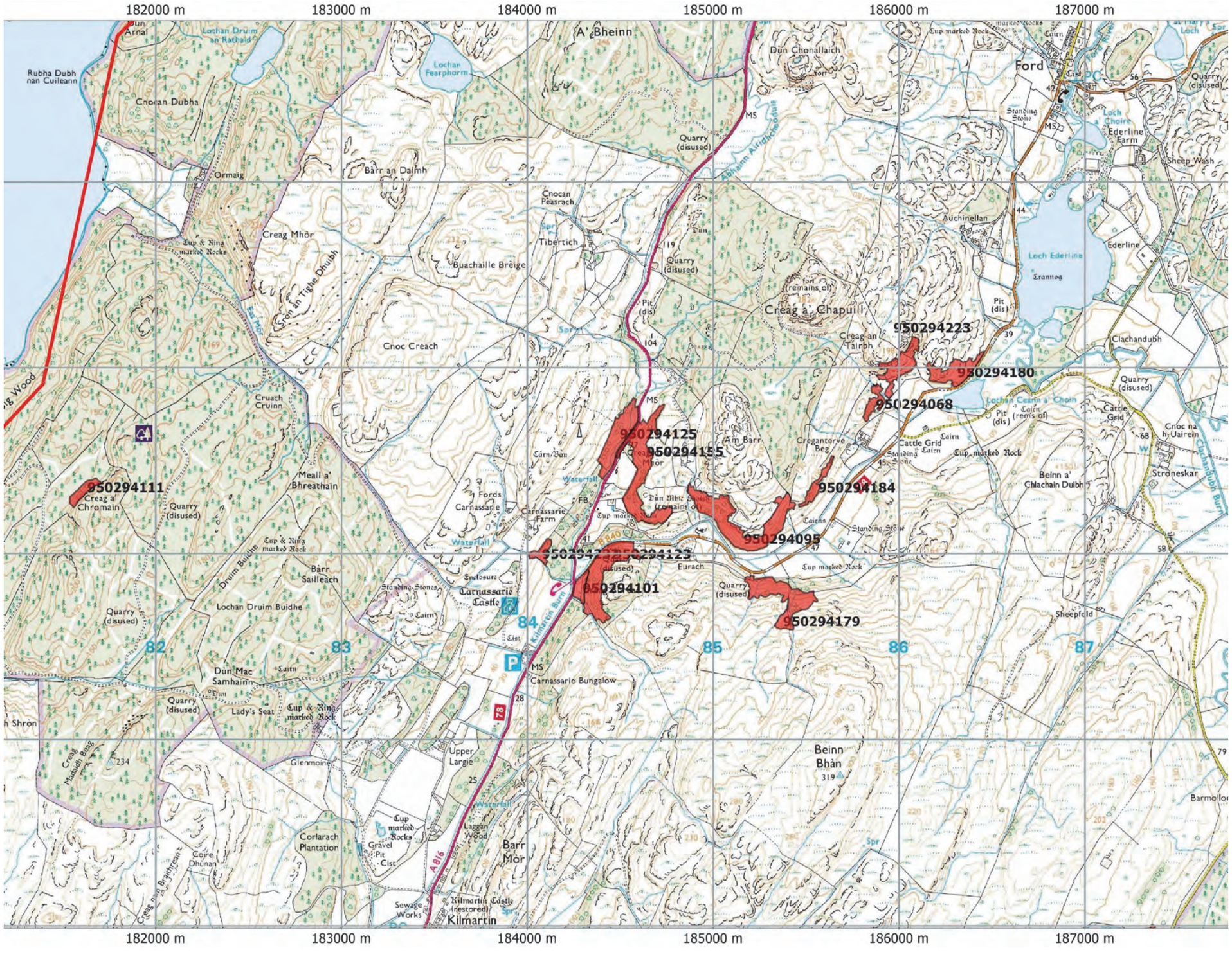


Map 8. Glen Shira



Map 9. Garraron and Barbreck

Map 10. Ardfern and Croabh Haven

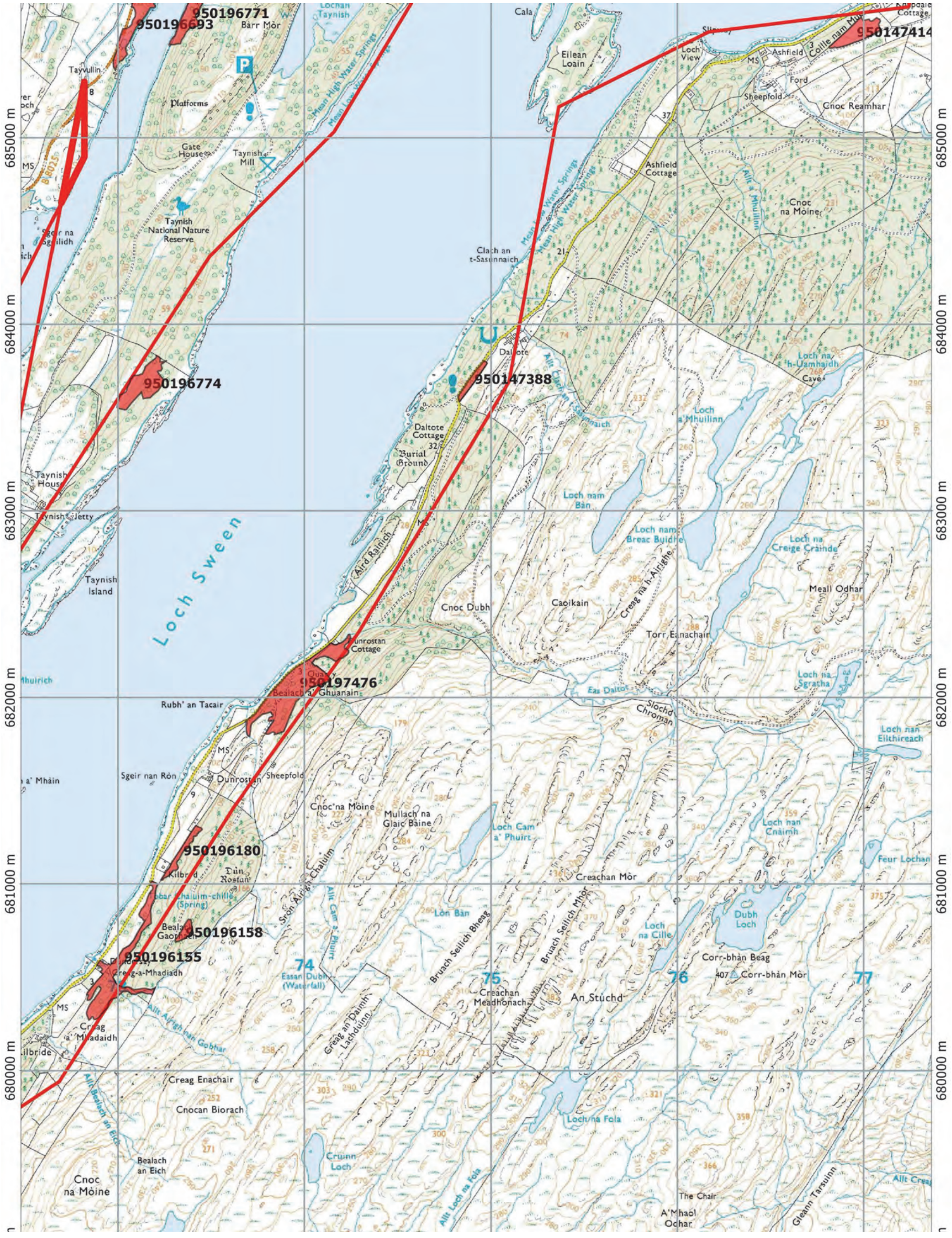


Map 11. Carnessarie west

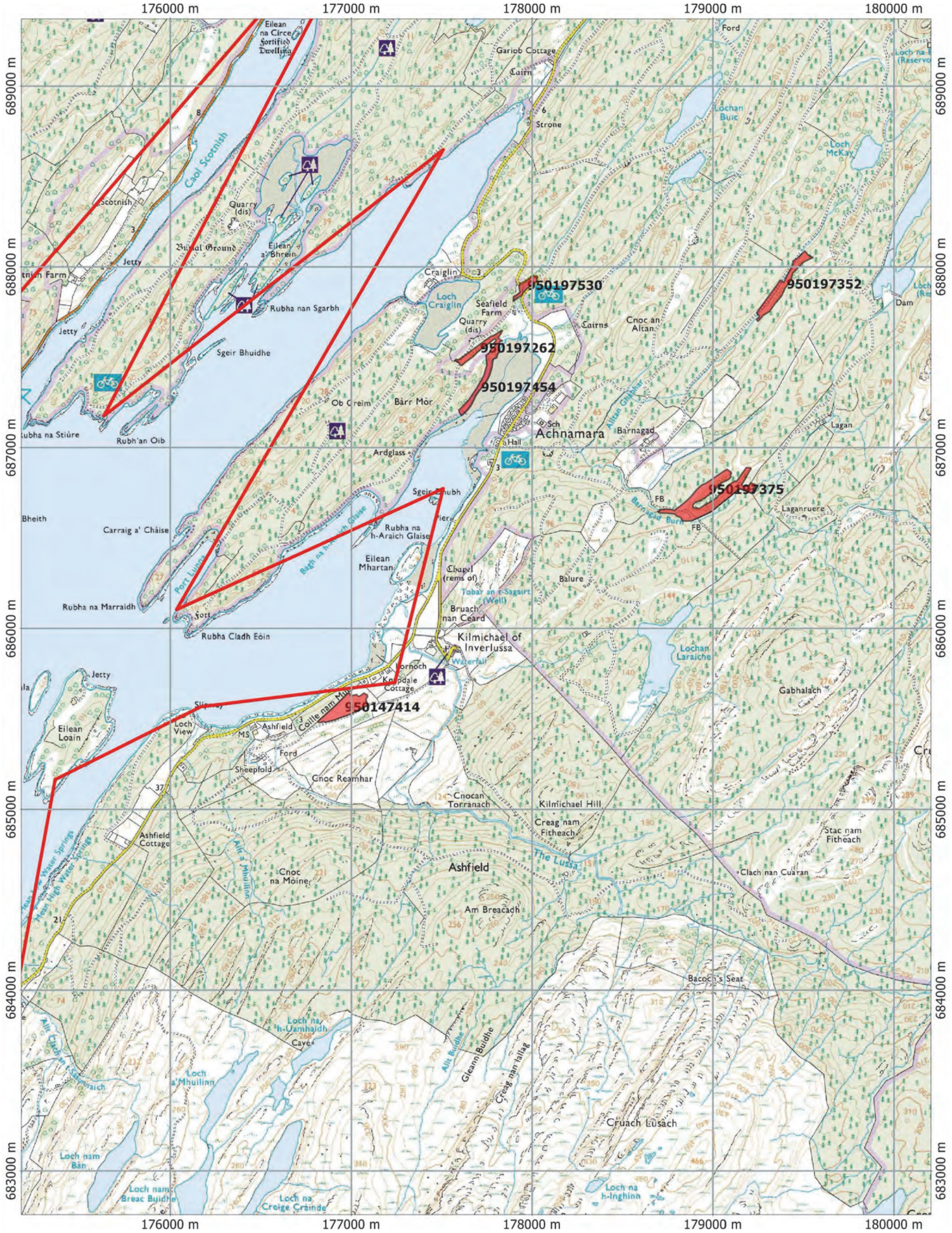
Map 12. Stockavullin


188000 m
189000 m
190000 m
191000 m
192000 m
708000 m
707000 m
706000 m
705000 m
704000 m
703000 m
702000 m
Minor
Old Shielings
Loch a' Mhinn
River Liever
Creag Dhubh
Druim a' Chuilteir
Allt Criche
Creag Gharbh
102
78
Cnoc Feadaige
Sheepfold
Quarry (disused)
Rubha
Arinechtan
154
Quarry
Quarry
FB
Cnoc nan Carnach
Cnoc an t-Sasunnaich
Cnoc na Moine
Inverliever Lodge
Waterfalls
Arichamish
Arichamish Point
950222073
Cnocan a' Chaorainn
Creagan Faing
Sheepfold
Ford
Ford
Weir
Nursery
Cairn
Liever Island
Crannog
Cross incised stone
Torran Farm
Dun Toiseach
Cup & Ring marked Rock
Tower (rems of)
Rubha Mhic Chaisein
Rubha Cuilinn
Creag Laganach
Allt Mor
Waterfall
Finchairn Castle (remains of)
Cup Marked Rocks
Cup & Ring marked Rock
Waterfalls
Creag Liath
B840
Finchairn
Pier
Quarry (disused)
Kilneuair
St Columba's Church (remains of)
Sheepfold
Dubh Uisge
Sidh Mhor
Sron Mhor
Garbhallt
Ford
950294120
A' Chruach
Lon Glas
Sheep Pens
Fincharn River
Loch nan Ceard Beag
Loch nan Ceard Mor
Dubh Loch
Loch na Craoibhe Chaorainn
Ford
Fords
Cruach a' Bhea
Coire nan D
Sheepfold
01
02
03
04
05
06
07
08

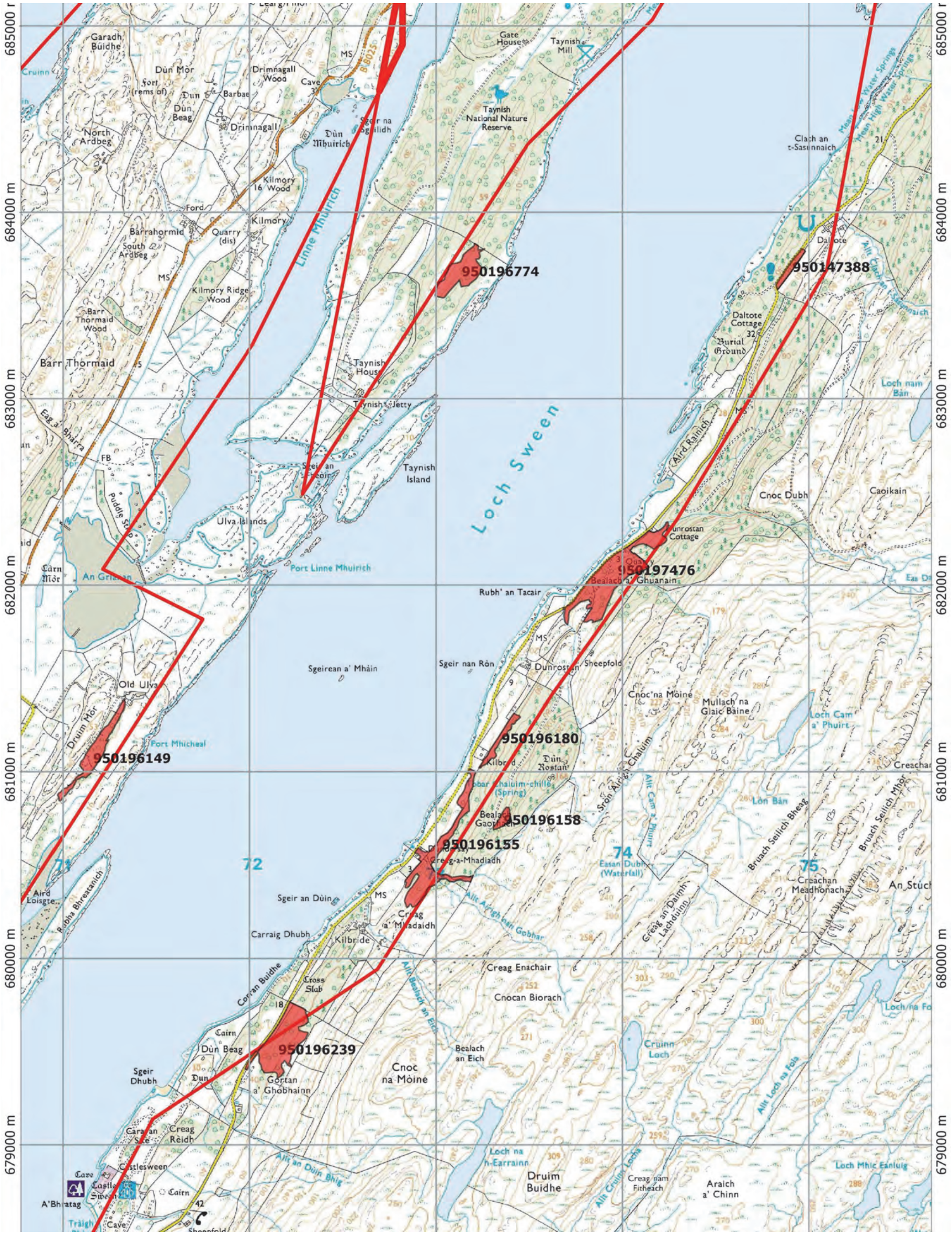
Map 13. Ford



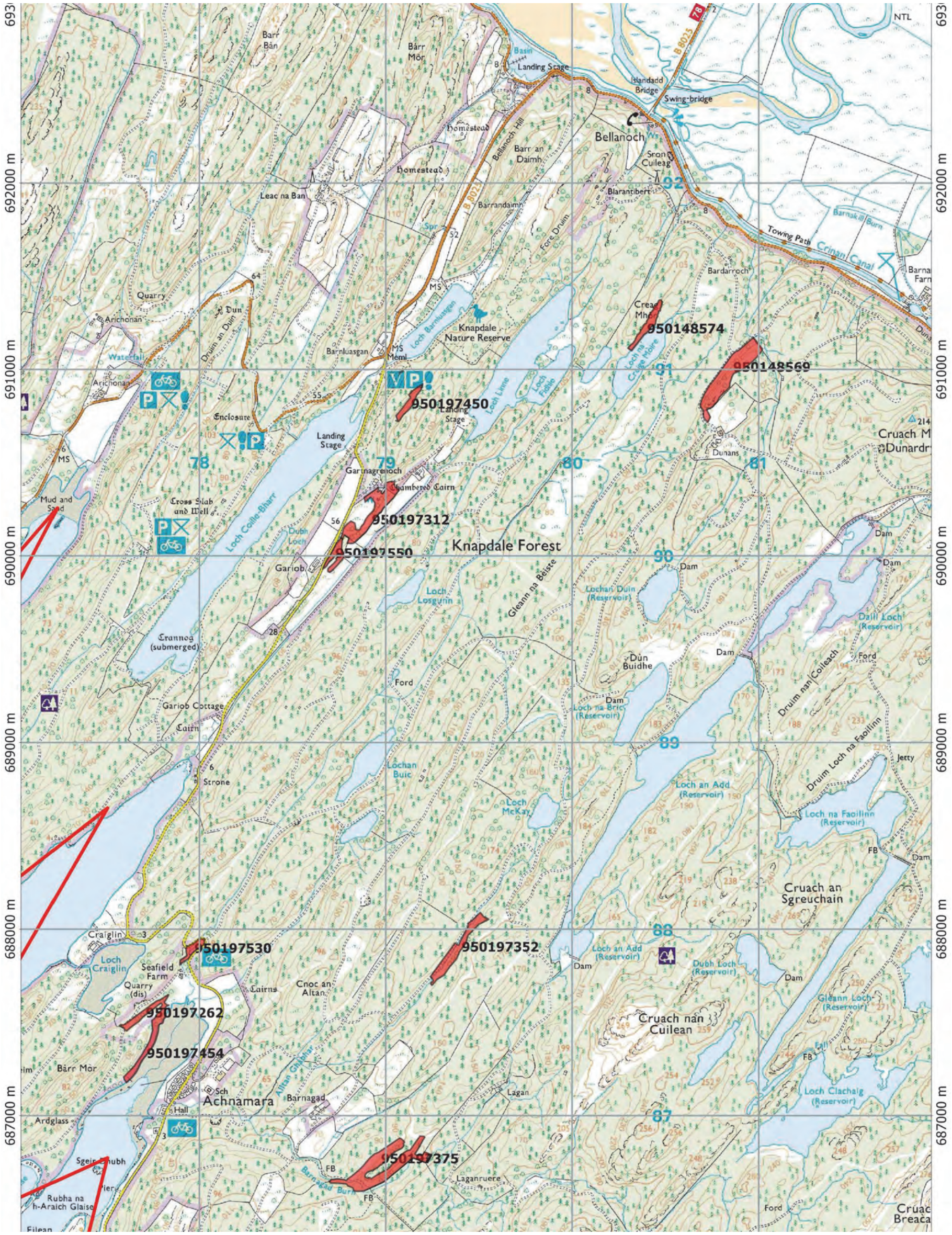
Map 14. East Loch Sween



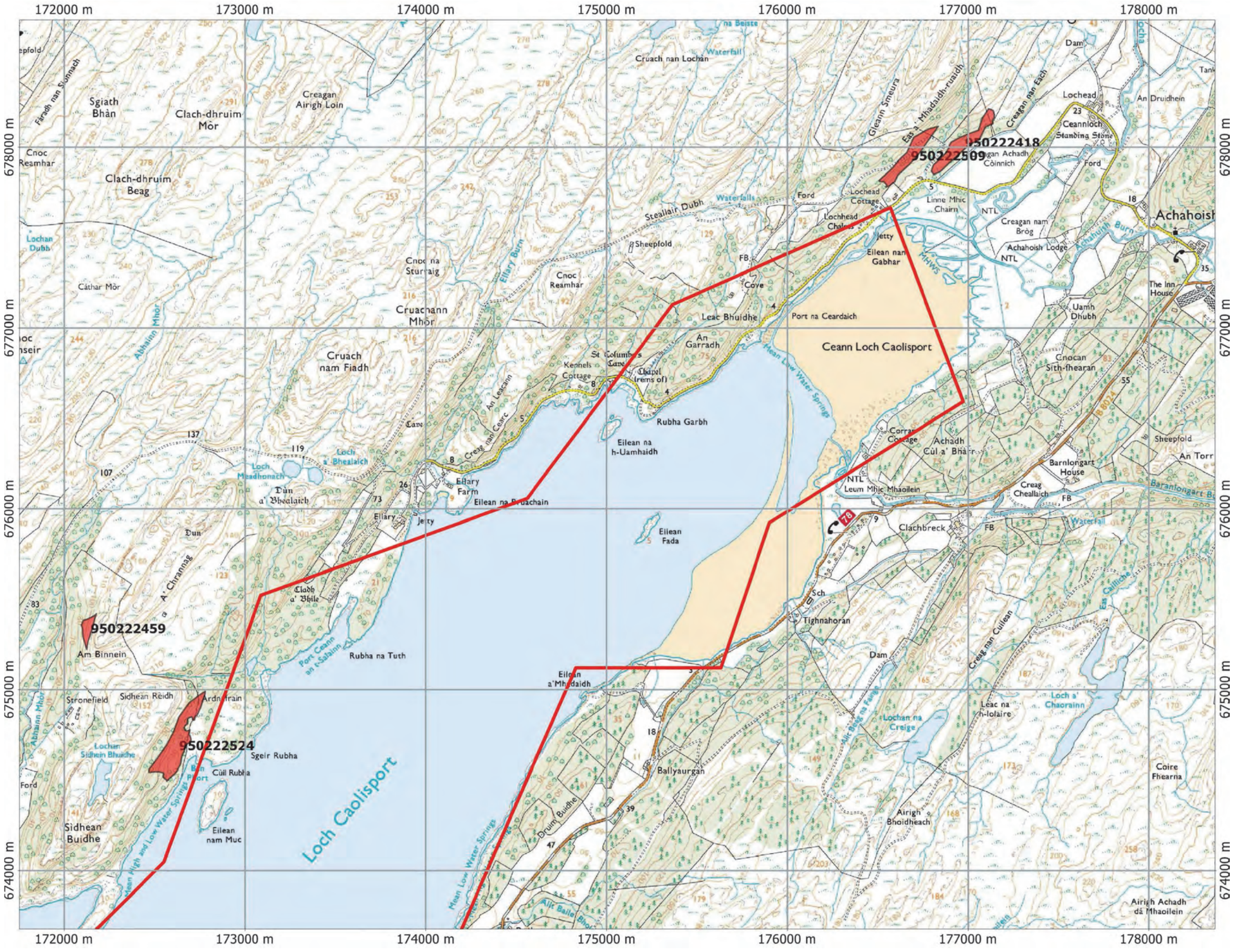
Map 15. Kilmichael of Inverlussa



Map 16. South Loch Sween

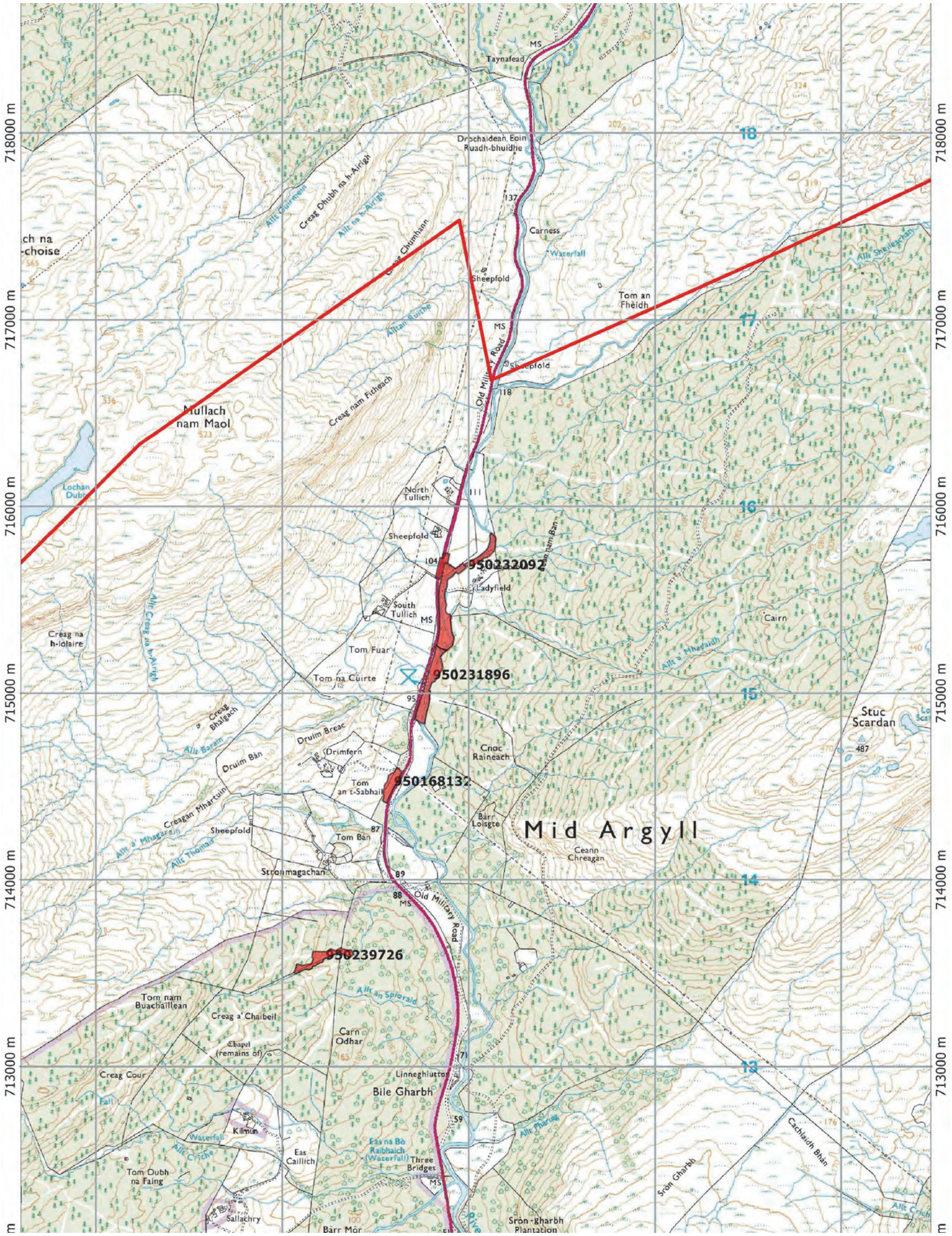


Map 17. Barnlusagan



Map 18. North Loch Caolisport

Map 19. Ormsary



Map 20. Glen Aray

ANNEX 5: THE HAZEL ASSESSMENT TABLES (HATS)

The stand type of the hazel and the assessment of the condition of hazel stand follow the guidelines in Coppins & Coppins (2012). Refer to Coppins & Coppins (2012) for more guidance on completing forms.

Determining the Atlantic hazel stand type present (from Coppins & Coppins, 2012)

Type A Closed canopy, multi-stemmed stands of pure hazel
Type B Scattered hazels in pasture
Type C Veteran hazels
Type D Hazel in woodland (including ravines)

There may be one clearly defined hazel stand type, **but it is more likely that there will be several of the following, blending together, or as mosaics amongst other habitats.** Type C is fairly distinctive, but may be part of Types B & D.

Key to Atlantic hazel stand types

1 Closed canopy, multi-stemmed stands dominated by hazel; sometimes difficult to walk between the individual hazels **2**

Open canopy, individual hazels variously spaced, sometimes in small clumps with open, grazed areas between; easy to walk between them **4**

2 Closed canopy, multi-stemmed stands dominated by hazel; sometimes difficult to walk between the shrubs **Type A**

Closed canopy, mostly multi-stemmed stands of hazel, but other woody species (e.g. birch, oak, ash, holly, rowan, etc.) present **3**

3 Closed canopy, mostly multi-stemmed stands of hazel, but other woody species present but comprising < 25% of the overall stand. **Type A**

Closed canopy, mostly multi-stemmed stands of hazel, but other woody species present but comprising > 25% of the overall stand (this also applies to hazel in ravines) **5**

4 Hazel in small clumps or scattered mosaics, or widely spaced; can be present as multi-stemmed forms, or with few stems to each hazel and occasionally 'tree-like'; other tree/shrub species may/may not be present as rare/occasional; in open, grazed mosaics, sometimes with bracken. **Type B***

Hazel present mostly as a few veterans of considerable size and age; can be at edge of woodlands, or in open, brackeny slopes as a component of an old wood pasture habitat. **Type C***

5 Closed canopy (although there may be gaps in some situations where glades are present) with hazel present as a component of more mixed deciduous woodland; hazels mostly multi-stemmed, but often few stems in each shrub and tending to be gangly and drawn up. . . . . **Type D**
Hazels in ravines . . . . . **Type D**

***** Types B & C: an intermediate stage between Type B and the giant veteran hazels of Type C would be hazel 'trees'.

What do the results mean? (The following Table is taken from the guidelines for assessment of results as presented in Coppins & Coppins, 2012)

Hazel stand types	Threshold score	Maximum score
Type A HAT.2 + HAT.3	**14**	**31**
Type B HAT.2 + HAT.3	**13**	**30**
Type C HAT.2 + HAT.3	**14**	**31+**
Type D HAT.2 + HAT.3	**15**	**33**
These scores are derived from combining HAT.2 and HAT.3, as shown below:		
Atlantic Habitat Condition HAT.2		
Type A	**5**	**6**
Type B	**4**	**5**
Type C (veterans)	**5**	**6+**
Type D	**6**	**8**
Atlantic Hazel Biodiversity Assessment HAT.3	**9**	**25**

ATLANTC HAZEL RECORDING FORM
The following is the completed Hazel Assessment form (adapted from Coppins, 2012) for the hazel stand recorded with hazel gloves fungus at Lergychoniebeag.

Subcompt no.	950246638	**Surveyor(s)**	**AA**
Grid ref	NM 82591 08438	**Date**	**28/02/2013**

Site Description – briefly describe area(s) of hazel assessed e.g. 'along lower slope with stands quite open with scattered old bushes; canopy closed in some places, but forming open gladed mosaics. Most hazel with few stems (<5) & little evidence of young shoots establishing. Hazel gloves on two bushes. Occasional hawthorn, with willow by burn. Grazed by sheep (Type B).'

Hazel on a knoll/ridge – heavily grazed by sheep

HAT.1. If you have more than one e.g. of any type, then make that clear, e.g. 'Type A present in three places (with approx. grid refs); Type B scattered and wide-spread throughout.' If easier or clearer, use separate copies of **HAT.1**

HAT 1 ATLANTIC HAZEL STRUCTURE TYPES	**Distn**. local, patchy, scattered, widespread	**No. of times recorded or frequency**	**Seen at these grid refs**	**Approx. area** (for Type C give no. of veterans)
Type A Pure hazel				**0.59**
Type B: scattered hazels in pasture (incl. occ. 'tree' hazels)				0
Type C: veteran hazels				0
Type D: Hazels in woods (incl. ravines)				0

HAT 2. HABITAT CONDITION To avoid confusion with SCM, don't use 'favourable' and 'unfavourable' but 'good' and 'poor'. Use a separate sheet if there is more than one e.g. of each type.

Type A (closed canopy, pure hazel) *For each hazel patch of type A score 1 for yes, 0 for no*	**Patch 1**	**Patch 2**	**Patch 3**
Closed canopy mostly intact (apart from some occasional glades)	1		
Hazels often small, evenly-spaced, with slender to medium-sized stems (c. 3-25 cm girth)	1		
Ground flora not (or slightly) trampled, few bare areas or tracks/paths occasional	0		
Stems mottled with bryophytes and lichens	1		
Light, seasonal grazing, or grazing by a few deer, evidence of some basal shoots being browsed	0		
At least 4 in 20 hazels, with a young shoot (whip) reaching/nearly reaching canopy, i.e. 1 in 5 hazels with viable growth dynamics, even with low grazing levels	0		
Total score for Type A (max = 6)	**3**		

Type B (Scattered hazels in pasture including occasional small hazel 'trees'). *For each hazel patch of type B score 1 for yes, 0 for no*	**Patch 1**	**Patch 2**	**Patch 3**
Most scattered hazels robust, with many stems of varying thickness, and canopy wide-spreading			
Ground flora not (or only slightly) trampled, with few bare areas or just occasional tracks/paths			
If hazels are reduced to a few thickened stems, are there signs of recovery, with viable, well-established regeneration present (on at least one hazel in five)?			
Stems mottled with bryophytes and lichens			
Light seasonal grazing, or grazing by a few deer, with evidence of a few basal shoots being browsed			
Total score for Type B (max = 5)	**0**		

Type C (veteran hazels, or veteran hazel 'trees')	**Patch 1**	**Patch 2**	**Patch 3**
How many veteran hazels are present within the site? **(score 1 for each veteran)**			
Do the veteran hazel 'trees' appear viable, i.e. at least some viable canopy present above grazing height? **(score 1 point for each veteran)**			
Trunk(s) is/are stable, and not requiring pruning **(score 1 point for each)**			
If in imminent danger of collapse, is there potential for remedial pruning/pollarding, in order to preserve the hazel? **(score 1 point for each veteran where this action would be applicable)**			
Trunks with bryophytes and lichens present (score 1 for yes, 0 for no)			
Are veterans within a pasture woodland habitat today? (score 1 for yes, 0 for no)			
Total score for Type C (min = 5)	**0**		

Type D (Hazel in woodland, including ravines) For each hazel patch of type C score 1 for yes, 0 for no	**Patch 1**	**Patch 2**	**Patch 3**
Hazels forming discrete mosaics amongst other tree spp. (e.g. at streamsides)			
Glades present			
Individual not widely separated (isolated) from other hazels, i.e. < 20m apart			
Hazels not reduced to one or two stems only			
Hazels not becoming tall and gangly, drawn up by being shaded from increased canopy development or infill from taller tree species (unless in ravines)			
Ground flora not (or only slightly) trampled, with few bare areas, or just occasional tracks/paths			
Stems mottled with bryophytes and lichens			
Evidence of light seasonal grazing, or grazing by a few deer, so that at least 1 in 5 **basal shoots** are successfully getting away to maintain viability of the hazel(s)			
Total score for Type D (max = 8)	**0**		

Total HAT 2 score For ALL Hazel Types Present (A, B, C, D)	**3**

DETERMINING THE BIODIVERSITY IMPORTANCE OF THE ATLANTIC HAZEL STAND
Record each patch of hazel separately as there may be significant differences between stands.

HAT.3 BIODIVERSITY ASSESSMENT For each patch **score 0 for none 3 for some 5 for plenty**	**Patch 1**	**Patch 2**	**Patch 3**
Smooth bark on young stems: does it have patches of crustose lichens (whitish, creamy, silvery, greenish or brownish areas) forming mosaics on the bark?	3		
Are there bryophytes (mosses and liverworts) on the stems?	5		
Are some of the leafy-lobed lichens present on the stems?*	3		
Is the hazel gloves fungus present?	3		
Is the glue fungus present?	5		
HAT. 3 Total (max = 25)	**19**		

RESULTS (summary of HATs 1, 2, 3)

HAT 4 SUMMARY OF ATLANTIC HAZEL RESOURCE This is just a summary of the total hazel resource, and are *not* be added to the condition assessment and biodiversity assessment scores in HAT 5		
Sum of all hazel present (from **HAT.1)**	Approx. area included	No. of patches of hazel/no. of veterans). **Count 1 for each patch, 1 for each veteran**
Type A (closed canopy, pure stands)	**0.59**	1
Type B (scattered hazel in pasture)		
Type C (veteran hazels)		
Type D (hazel in woods incl. ravines)		

HAT 5 SUMMARY OF ATLANTIC HAZEL ASSESSMENT	
Overall total score for habitat condition assessment (**from HAT 2**)	**3**
Overall total score for biodiversity assessment**(from HAT 3)**	**19**
Grand Total of Score	**22**

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ISBN: 978-1-78391-337-4

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