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## **Coire Glas Pumped Storage Scheme Arctic Charr Habitat Survey**



**December 2017**



# Coire Glas Pumped Storage Scheme

## Arctic Charr Habitat Survey

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## 1 INTRODUCTION

### 1.1 Aim and objectives

The aim of the study was to determine whether there is suitable spawning habitat in Loch Lochy for Arctic charr, in order to inform the impact assessment of the Coire Glas pumped storage scheme on Arctic charr. This was achieved through the following objectives:

- Use existing data to identify areas of potential Arctic charr spawning habitat in Loch Lochy;
- Survey the above potential areas for evidence of spawning gravels; and
- Estimate how much spawning habitat is available for Arctic charr in Loch Lochy.

### 1.2 Arctic Charr in Scotland

Scotland is a stronghold for Arctic charr with approximately 258 wholly loch resident populations (Maitland *et al* 2007<sup>1</sup>). There are currently no records of anadromous populations of Arctic charr in Scotland. It is known that 12 of the recorded populations of Arctic charr in Scotland have gone extinct; the number of extant populations has not been verified for a number of years and it is therefore possible that some more populations have been lost and others never discovered. Arctic charr is one of ten boney fish listed on the Scottish Biodiversity List (SBL).

### 1.3 Loch Lochy

There are anecdotal reports of Arctic charr in Loch Lochy but in recent times there have been no reliable verified or published records. There is much public debate surrounding the presence of Arctic charr in Loch Lochy with some forums suggesting that there are particularly large fish to be found in Loch Lochy, in part due to supplementary feeding in the vicinity of the fish farm. The UK rod and line caught record specimen Arctic charr fish was caught in Loch Arkaig. Loch Arkaig is situated to the west of Loch Lochy and is connected to Loch Lochy by the River Arkaig which flows west to east (Figure 1).

Based on the uncertainty of the presence of Arctic charr, its high conservation value, and scoping opinions from Marine Scotland Science (MSS) and Lochaber Fisheries Trust (LFT), it was recognised that further survey work was required to inform an assessment of the impact of the proposed Coire Glas pumped storage scheme on Arctic charr in Loch Lochy.

### 1.4 Biology

In Scotland Arctic charr are known to congregate in large numbers in deep water. Spawning occurs in autumn and early winter on well washed gravels and pebbles up to 100mm in size and ideally 30-40mm, often along the shoreline of lochs. A small number of populations are known to spawn in streams, however, the extent to which this occurs is unknown and understudied (Walker 2007)<sup>2</sup>. In the literature there is support for the hypothesis that Arctic charr have evolved in competition with brown trout and, through ecological character displacement, adapted to their present niche (Forseth *et al* 2003)<sup>3</sup>. Where trout and Arctic charr co-exist Arctic charr feed on animal plankton, deep-water pea mussels and midge larvae.

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1 Maitland, P. S., Winfield, I. J., McCarthy, I. D. and Igoe, F. (2007). The status of Arctic charr *Salvelinus alpinus* in Britain and Ireland. *Ecology of Freshwater Fish* 16: 6-19.

2 Walker (2007). Stream Spawning of Arctic charr in Scotland. *Ecology of Freshwater Fish* 16: 47-53.

3 Forseth, T, Ugedal, O, Jonsson, B, and Fleming, I. A. (2003). Selection on Arctic charr generated by competition from brown trout. *OIKOS* 101, 3: 467-478.

## 2 METHODS

At present the operating regime for the proposed pumped storage scheme is unknown therefore the worst case scenario must be considered. In relation to Arctic charr this would be prolonged or frequent drawdown during the spawning season, exposing eggs to be dried out and lost. Prior to the commencement of survey work advice was sought from Professor Colin Adams, Professor of Freshwater Ecology (University of Glasgow, Institute of Biodiversity Animal Health and Comparative Medicine) who is an established and well known expert in Arctic charr.

In order for the survey effort to be targeted towards preferred areas a review of the shoreline characteristics of Loch Lochy was undertaken. This included reviewing work completed in 2017 that identified areas of Loch Lochy with suitable spawning gravels for salmonids<sup>4</sup>, and interrogating existing maps of loch bathymetry, superficial deposits and the predicted influence of the prevailing winds to create well washed gravels. Points around the shoreline of Loch Lochy where spawning gravels could be located were identified (Figure 2). A large proportion of the east shore was scoped out as unsuitable for further survey as it is artificial reinforced bank.

The shoreline of the loch was accessed by boat and the survey commenced less than four metres from the shore in a depth of water less than one metre. From the boat a 'spyball' camera was deployed to view the substratum. Video footage and still images were viewed. Laser markers were used to estimate substrate size based on Scottish Fisheries Co-ordination Centre (SFCC) Habitat Survey guidelines<sup>5</sup>. A transect was driven with a continuous view being provided by the 'spyball'. When the substratum became unsuitable for spawning Arctic charr the water depth was recorded and the survey stopped.

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4 Watt (2017). Loch Lochy inflow streams: assessment of access for spawning salmonids. Commissioned report to ASH design + assessment Ltd.

5 SFCC (2007). Habitat Surveys Training Manual. Available at:  
<http://www.sfcc.co.uk/assets/files/SFCC%20Habitat%20Training%20Manual.pdf>

### 3 RESULTS

In total 17 locations were identified for survey. Only two of these had a substratum that warranted further investigation after the initial shoreline view of the loch bed (Table 1: sites 1 and 1a and 14 and 14a). Only one site, 14, had any suitable gravel and it was limited to small pockets between boulders.

**Table 1: Survey locations, depth of survey and substrate recorded**

Survey point	NGR	Substrate	Depth (m)	Photograph
1	NN 20879 88701	Pebble	<1m	1
1a	NN 20896 88689	Sand	<2m	2
2	NN 20727 88686	Pebble and weeds	<1m	3
3	NN 20552 88509	Pebble, cobble, weed and silt	1.75m	4
4	NN 20504 88507	Cobble	<1m	5
5	NN 20262 88064	Sand, cobble, boulder	3m	6
6	NN 24387 92176	Cobble, pebble	1m	7
7	NN 25327 93205	Cobble, pebble	<1m	8
8	NN 26571 94543	Pebble, cobble, sand	<1m	9
9	NN 27800 95384	Pebble, cobble	<1m	10
10	NN 28129 95496	Pebble, cobble	<1m	11
11	NN 27895 94913	Pebble, cobble, boulder, sand	<1m	12
12	NN 24913 91313	Cobble, pebble	<1m	13
13	NN 24692 90878	Sand, cobble, pebble	<1m	14
14	NN 22267 88389	Pebble, cobble, gravel (small pockets), sand	<1m	15
14a	NN 22212 88395	Sand	2m	No photo available
15	NN 22282 88298	Cobble, pebble, sand	<1m	16
16	NN 18697 86066	Pebble, cobble	<1m	17
17	NN 18793 85972	Sand, bedrock	<1m	18

## 4 CONCLUSION

No optimal habitat for Arctic charr to spawn in was recorded during the targeted survey of Loch Lochy shoreline. One area of suitable gravels was recorded but this was suboptimal at best (Photo 15).

In order to maintain suitable spawning gravels in the loch there needs to be a continuous supply of sediment transported by rivers. Loch Lochy lies in a steep sided valley with many small tributaries feeding in but very few significant watercourses to transport gravels. The River Arkaig connects Loch Arkaig and Loch Lochy and provides spawning habitat for Atlantic salmon, brown trout and anecdotally ferox trout. This could also be the case for Arctic charr. It is also possible that the reports of Arctic charr in Loch Lochy are individuals that on occasion have moved from Loch Arkaig.

It is noted in the literature that Arctic charr are a habitat generalist like no other and within a lake can use all major habitats and depth zones (Klemetsen *et al* 2003)<sup>6</sup>. Arctic charr prefer the littoral zone but can shift flexibly to pelagic or profundal zones under competition. Halvorsen *et al* (1997)<sup>7</sup> found that parr of trout and salmon occupied the littoral habitat in several north Norwegian lakes while Arctic charr were found in the deeper and pelagic zone. Arctic charr have been recorded at depths of 220m in Loch Ness (Shine *et al* 1993)<sup>8</sup>. It is therefore possible that if Arctic charr are present in Loch Lochy then they could be utilising much deeper areas of the loch not surveyed, and at depths that will not be impacted by the operation of the proposed Coire Glas pumped storage scheme.

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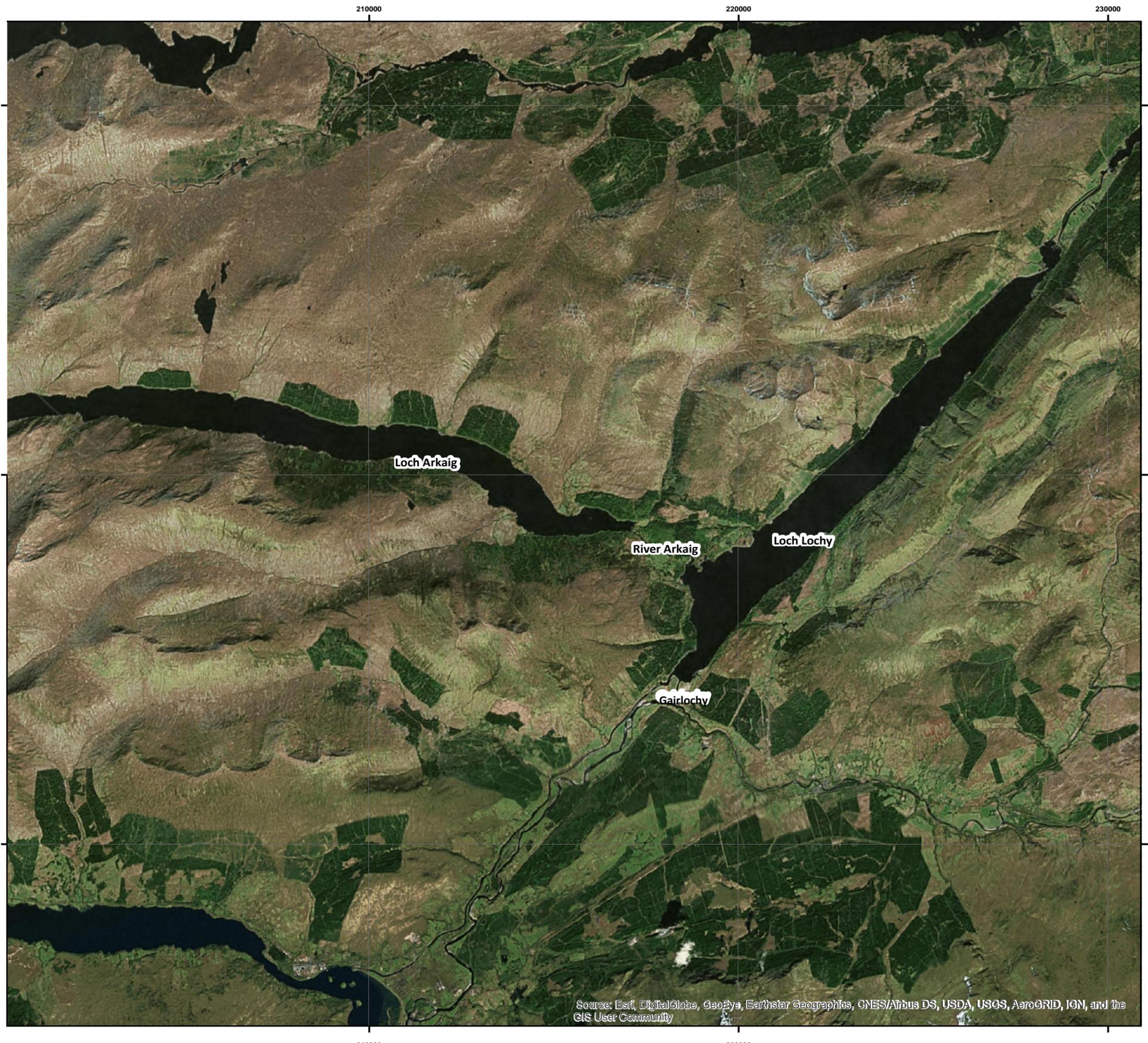
6 Klemetsen, A, Amundsen, P. A, Dempson, J. B., Jonsson, B., Jonsson, N., O'Connell, M. F. and Mortensen, E. (2003). Atlantic salmon *Salmo salar* L., brown trout *Salmo trutta* L. and Arctic charr *Salvelinus alpinus* L.: a review of aspects of their life histories. *Ecology of Freshwater Fish* 12.1: 1-59.

7 Halvorsen, M., Jørgensen, L. and Amundsen, P. A. (1997). Habitat utilisation of juvenile Atlantic salmon (*Salmo salar* L.), brown trout (*Salmo trutta* L.) and Arctic charr (*Salvelinus alpinus* L.) in two lakes in northern Norway. *Ecology of Freshwater Fish* 6:67-77.

8 Shine, A. J., Kubecka, J., Martin, D. S. and Duncan, A. (1993). Fish habitats in Loch Ness. *Scottish Naturalist* 105: 237-255.

## **APPENDICES**

## **A SITE LOCATION**



Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Legend

Do not scale this map

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Title  
Appendix 13.2 - Figure 1: Site Location

Status  
**FINAL**

Drawing No. 169281-002	Revision
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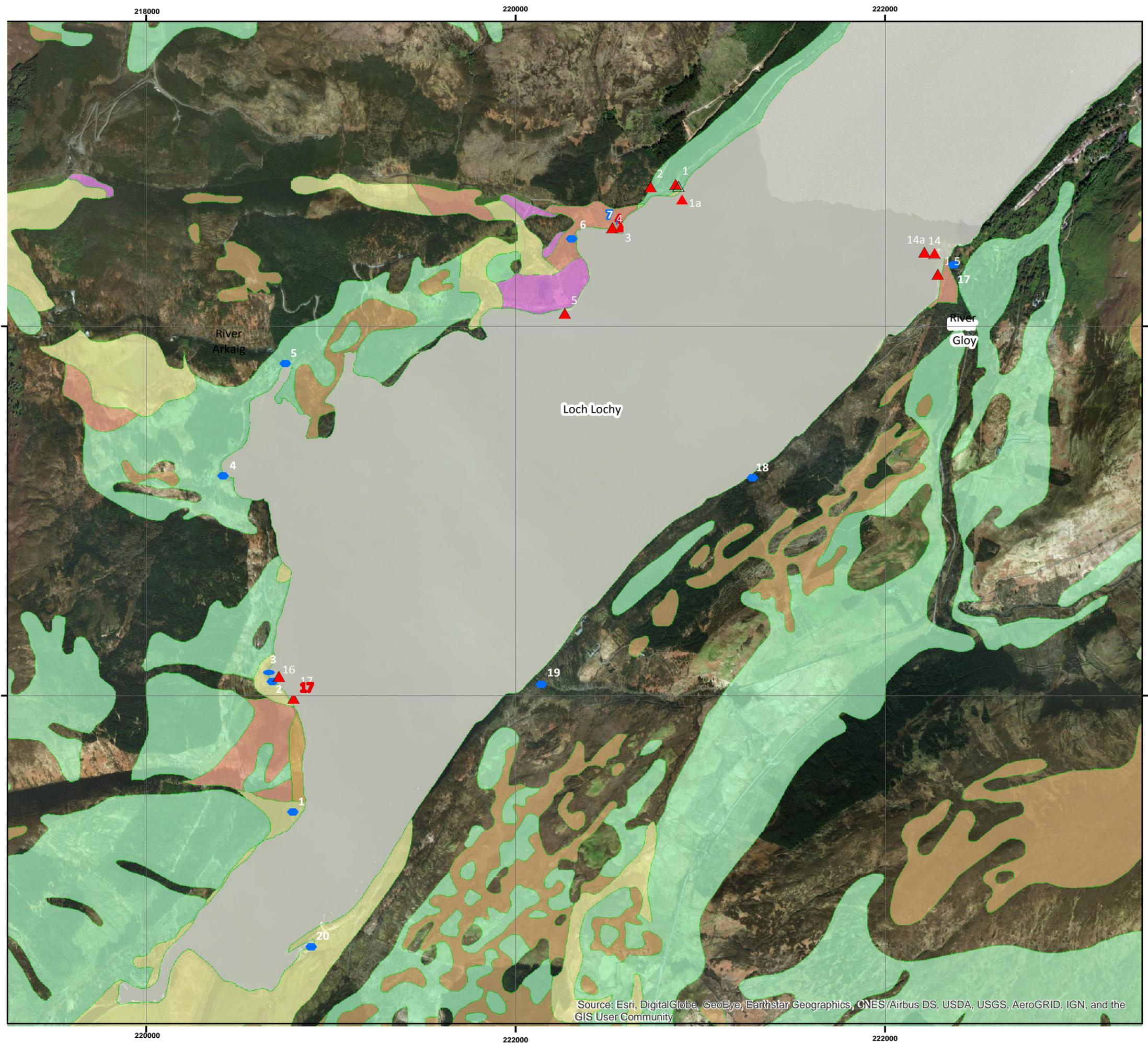
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Drawn GV	Checked GV	Approved KD
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## **B HABITAT SURVEY LOCATIONS**



**Legend**

- ▲ Habitat Survey Location
- Inflow Streams Survey Points (Watt October 2017)
- Alluvial Fan Deposit - Gravel, Sand, Silt and Clay
- Alluvium - Clay, Silt, Sand and Gravel
- Alluvium and River Terrace Deposits - Gravel, Sand, Silt and Clay
- Glacial Deposits - Diamicton, Sand and Gravel
- Glaciofluvial Deltaic Deposits - Gravel, Sand and Silt
- Glaciofluvial Sheet Deposits - Gravel, Sand and Silt
- Peat
- Till - Diamicton
- Unspecified

Do not scale this map

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**Coire Glas Pumped Storage Scheme**

Title  
**Appendix 13.2 - Figure 2: Habitat Survey Locations  
Map 1 of 3**

Status  
**FINAL**

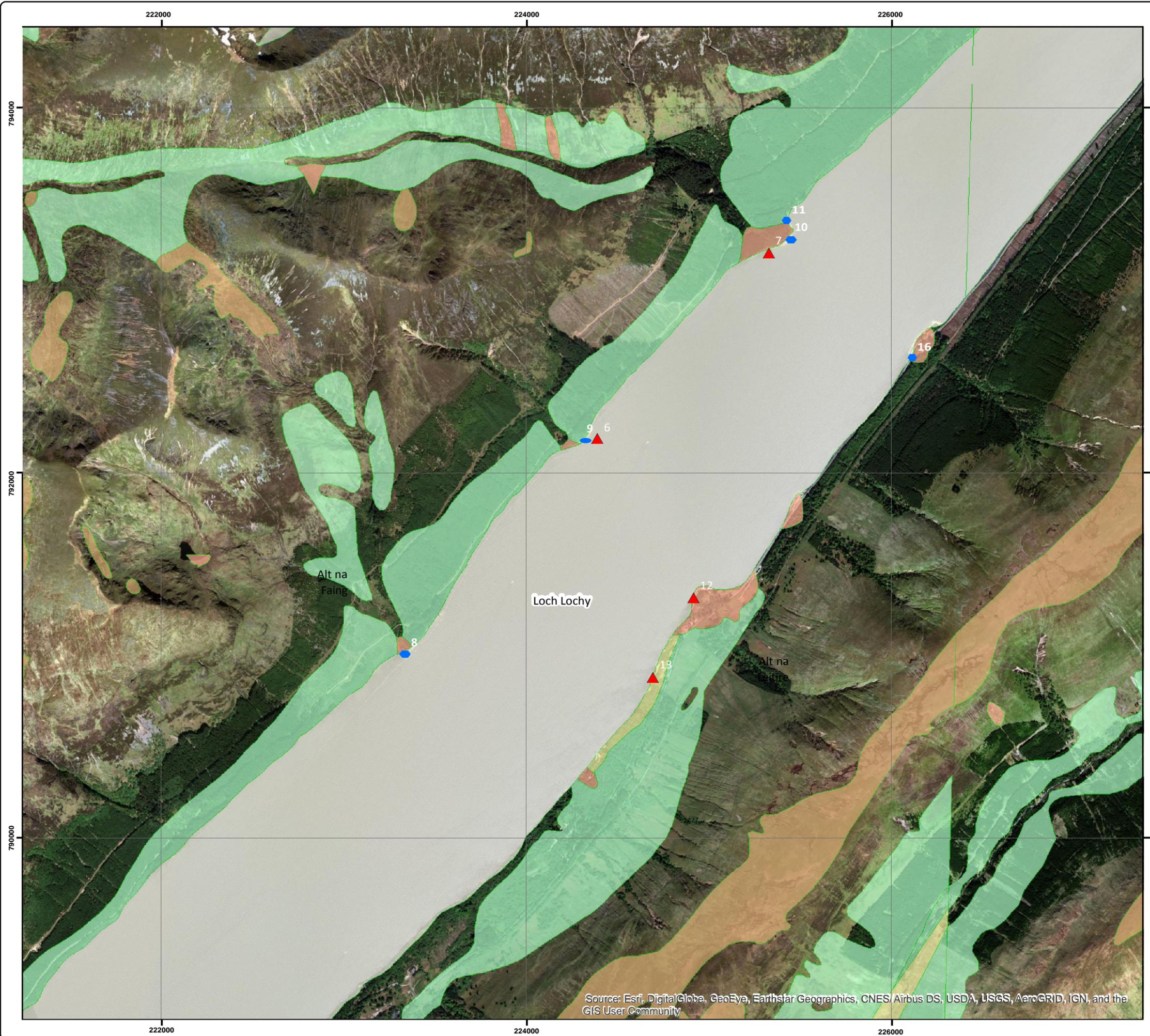
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Drawn GV	Checked GV	Approved KD
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Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community



**Legend**

- ▲ Habitat Survey Location
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- Glaciofluvial Sheet Deposits - Gravel, Sand and Silt
- Peat
- Till - Diamicton
- Unspecified

Do not scale this map

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**Coire Glas Pumped Storage Scheme**

Title  
**Appendix 13.2 - Figure 2: Habitat Survey Locations  
Map 2 of 3**

Status  
**FINAL**

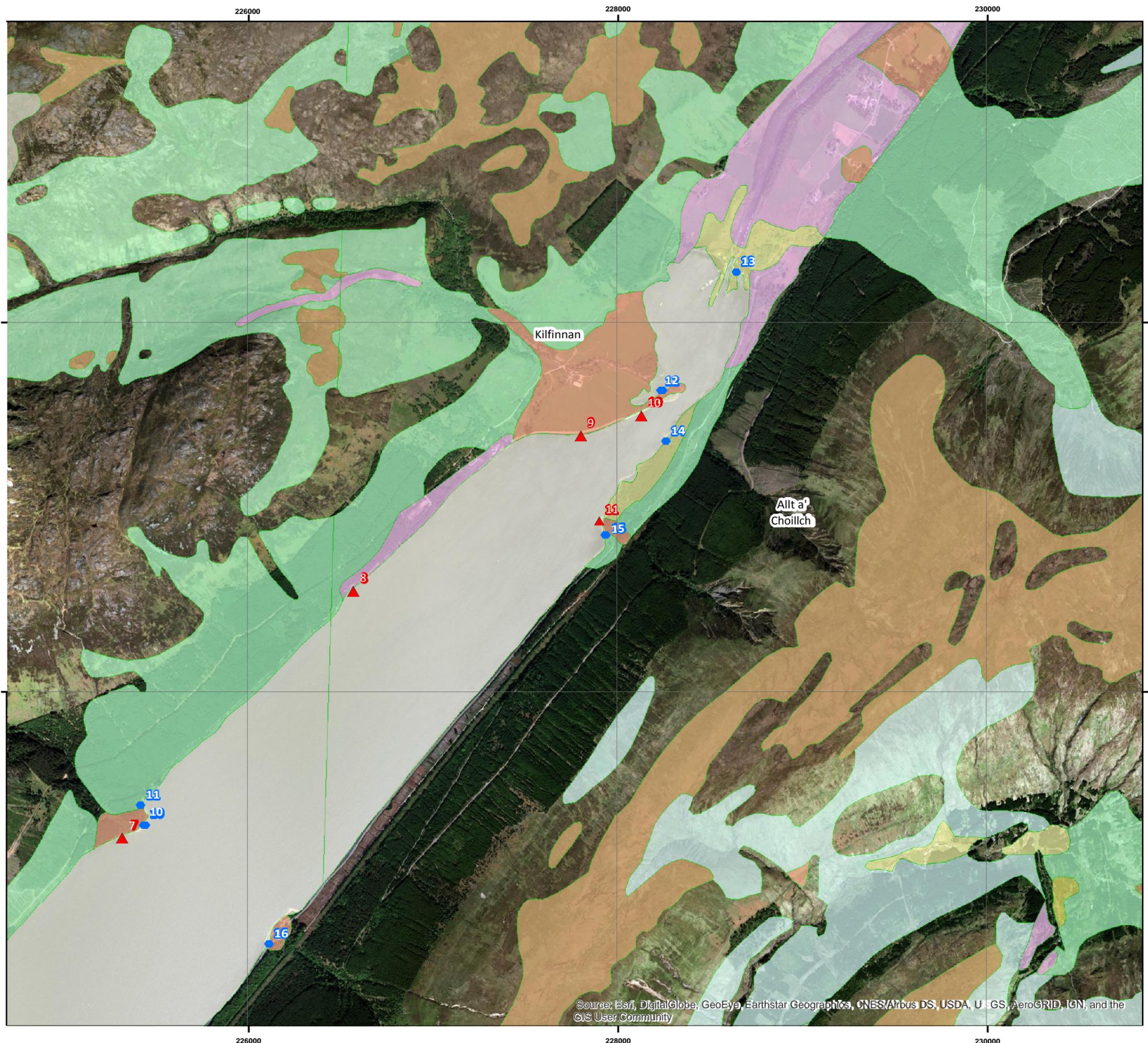
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Drawn GV	Checked GV	Approved KD
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**Legend**

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- Glaciofluvial Sheet Deposits - Gravel, Sand and Silt
- Peat
- Till - Diamicton
- Unspecified

Do not scale this map

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**Coire Glas Pumped Storage Scheme**

Title  
**Appendix 13.2 - Figure 2: Habitat Survey Locations  
Map 3 of 3**

Status  
**FINAL**

Drawing No. 169281-003a	Revision
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Drawn GV	Checked GV	Approved KD
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## C PHOTOGRAPHS



Photograph 1: Pebble



Photograph 2: Sand



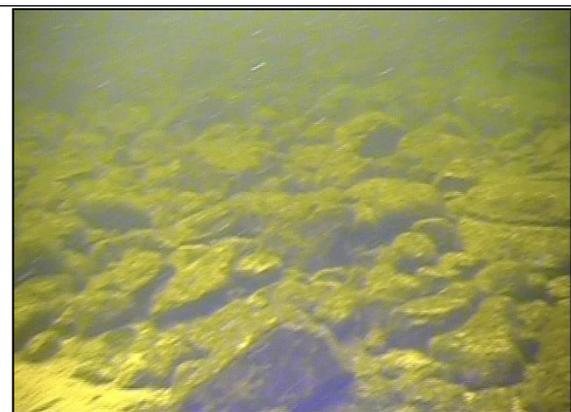
Photograph 3: Pebble and weeds



Photograph 4: Pebble, cobble, weed and silt



Photograph 5: Cobble



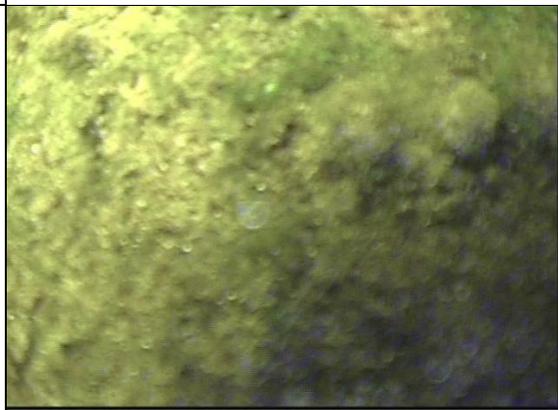
Photograph 6: Sand, cobble and boulder



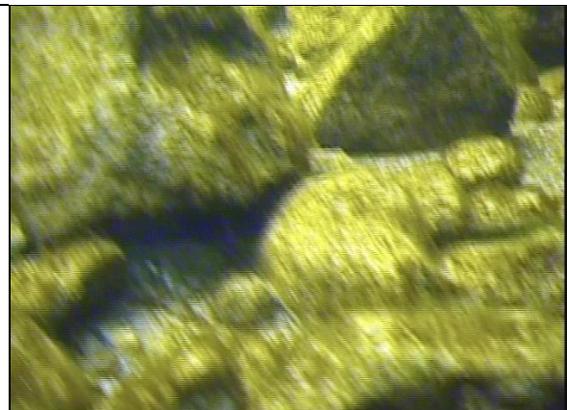
Photograph 7: Cobble and pebble



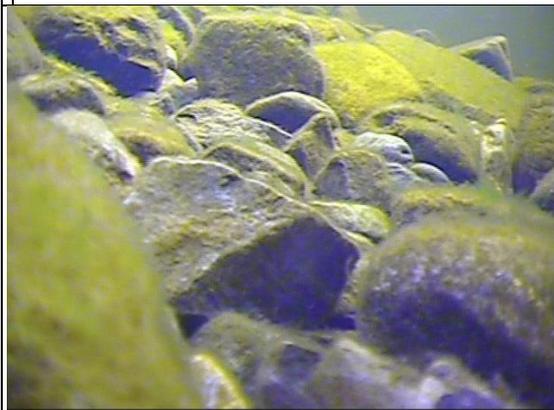
Photograph 8: Cobbles and pebble



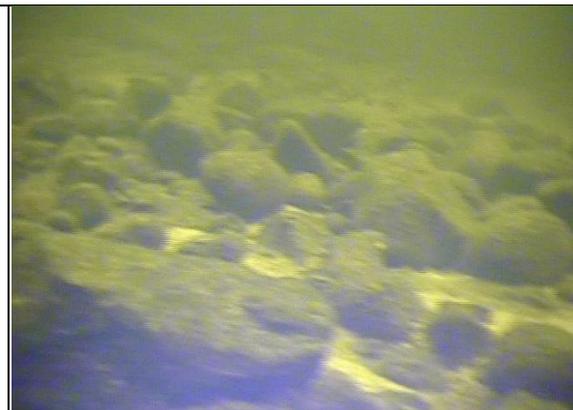
Photograph 9: Pebble, cobble and sand



Photograph 10: Pebble and cobble



Photograph 11: Pebble and cobble



Photograph 12: Pebble, cobble, boulder and sand



Photograph 13: Cobble and pebble



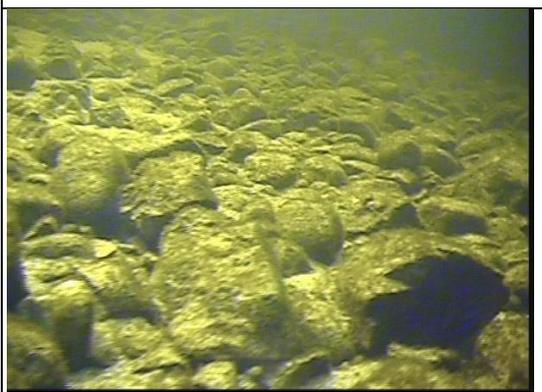
Photograph 14: Sand, cobble and pebble



Photograph 15: Pebble, cobble, gravel (small pockets) and sand



Photograph 16: Cobble, pebble, sand



Photograph 17: Pebble and cobble



Photograph 18: Sand and bedrock