

# Ben Hope SSSI – Bracken survey





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# COMMISSIONED REPORT

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**Commissioned Report No. 515**

## **Ben Hope SSSI – Bracken survey**

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## COMMISSIONED REPORT

# Summary

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## Ben Hope SSSI – Bracken Survey

**Commissioned Report No. 515 (iBids Project No. 12310)**

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### Summary

A bracken survey was carried out on the western side of Ben Hope SSSI for all areas below 350 metres. A total of ninety-one bracken polygons was recorded and fixed point photographs were taken of all stands. The habitats most affected by bracken encroachment were wet and dry heath with an estimated total of 45 hectares of wet heath and 47 hectares of dry heath affected.

Approximately half of the bracken stands were found to be patchily dense, a quarter were very dense and a third had only sparse bracken cover. Bracken fronds were mostly healthy and a third of stands were considered to be potentially invading.

Bracken expansion at this site is likely to be limited by climatic conditions and soil moisture status and expansion, if taking place at all, may be slow and localised. Potential bracken expansion should be monitored with the aid of repeat fixed point photographs, aerial photos and satellite imagery.

While bracken is not yet considered a threat to this site as no more than ten percent of any assemblage feature is thought to be affected, bracken distribution should be monitored and different methods of bracken control such as manual cutting and spraying should be considered to prevent this from becoming a more serious problem.

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## **1 INTRODUCTION**

### **1.1 Background**

The Site Condition Monitoring survey on Ben Hope SSSI in 2010 (Maier 2011) showed that both wet and dry heath components of the upland assemblage feature were in unfavourable condition due to high bracken cover. This problem was confined to the western part of the site below the 350 metre contour. Further information was required to inform a strategy for addressing unfavourable condition.

### **1.2 Aims**

The aim of the bracken survey was to quantify the extent and describe the location, condition, impact, and dynamics of bracken on the site, in a way which can inform possible future action to address this aspect of unfavourable condition.

### **1.3 Description of survey area**

The area surveyed was the western and northern part of the site below 350 metres, including a buffer zone in the north to the un-named burn 300m north of the Allt Merkan and in the south to the un-named burn near the broch Dun Dornaigil. The area below 350m is shown on the maps in Appendix 1. Most of this was steeper ground with wet heath and dry heath below cliffs, but there was also some blanket bog on level ground and on the shallower northern slopes. Woodland areas were excluded from the survey. Bracken was also looked for in other parts of the site while a concurrent Herbivore Impact Assessment was carried out but no bracken was found above 350m.

## **2 METHODS**

The bracken survey was carried out from the 27<sup>th</sup> to the 29<sup>th</sup> of July 2011 by Ruth Maier, Colin Wells and Tim Rafferty. Conditions were bright and sunny on the 27<sup>th</sup> and overcast with some rain during the morning on the 28<sup>th</sup> and 29<sup>th</sup> of July.

Each bracken stand was mapped in the field at a scale of 1:10,000, using other existing features such as streams, woodland patches and cliffs as reference points. GPS waypoints were recorded to mark polygon boundaries in the absence of such features but many boundaries were drawn by eye. Aerial photos (Next perspectives 2004) were consulted prior to and during field survey but stands of bracken could not be reliably distinguished from stands of *Myrica gale* from the photos alone. Small patches which were close together or areas with scattered, locally dense bracken fronds were often mapped as a single large polygon.

Each polygon was given a unique ID. For each polygon a number of variables were recorded and these are listed in table 1. Density was assessed using the density categories shown in Table 1. Photos 1-4 show examples for the density categories sparse, patchily dense, dense and continuously dense.

Bracken vigour was assessed using the bracken trend guidance from MacDonald (1998). It was difficult to distinguish between healthy invading and stable stands of bracken. Stands with abrupt boundaries were usually classed as stable whereas those with more diffuse edges were classed as healthy and invading.

Accessibility was assessed using the categories listed in Table 1. Roadside locations are accessible to normal road traffic.

**Table 1.** Attributes recorded for each bracken polygon.

<b>Attribute</b>	<b>Category</b>			
<b>Density</b>	Sparse - very scattered and never dense	Patchily dense canopy with continuous cover of other vegetation	Dense canopy with discontinuous cover of other vegetation	Continuously dense canopy with bracken litter and little cover of other vegetation
<b>Vigour</b>	Healthy and apparently invading	Apparently stable	Unhealthy and apparently retreating	
<b>Understorey</b>	Wet heath	Dry heath	Acid grassland	Calcareous grassland
<b>Accessibility</b>	Roadside location	Accessible to quad bikes	Accessible to pedestrians	Inaccessible



Photo 1. Sparse bracken in polygon 51. (Photo ID B56)



Photo 2. Patchily dense bracken in polygon 26. (Photo ID B18)



Photo 3. Dense bracken in polygon 25. (Photo ID B16). This is an example of healthy vigour



Photo 4. Continuously dense bracken in polygon 88. (Photo ID B129). This is an example of stable vigour.

Georeferenced fixed point photographs were taken of each polygon illustrating bracken density and polygon boundaries and providing a baseline for repeat monitoring of bracken at this site. Photograph numbers are listed in the bracken attribute table. Photo locations and directions are given in the bracken photo table spreadsheet. Both spreadsheets are attached in Appendix 2.

Polygons recorded by Tim Rafferty were digitised in the field directly into a MobileMapper using 1:25000 base maps. Mapping was aided by consulting an ipad with downloaded aerial imagery.

Colin Wells and Ruth Maier used physical features where possible and recorded waypoints for boundaries lacking such features to help transfer polygon boundaries

from the field maps into ArcView 3.1. Digitising of boundaries was carried out at a scale of 1:2,500 or larger.

### 3 RESULTS

Ninety-one bracken polygons were recorded. Most of these were located on the west-facing slopes, with a few outlying stands associated with small stream valleys in the northern part of the site. Maps are attached in Appendix 1. The bracken data table and bracken photo table are given in Appendix 2.

The main habitat affected by bracken is wet heath, which was the most abundant habitat in the survey area and present in 69 of the 91 bracken polygons. Dry heath was present in 37 polygons and acid grassland in six. Calcareous grassland is scarce at this site but small patches of bracken were found to be present in calcareous grassland patches below the cliffs of Leitir Mhuseil.

**Table 2.** Habitat types affected by bracken encroachment. Percentages are given in brackets.

	<b>Number of polygons</b>	<b>Total area affected in hectares</b>
<b>Wet heath</b>	48 (53)	27.65
<b>Dry heath</b>	17 (19)	28.24
<b>Acid grassland</b>	3 (3)	0.74
<b>Wet heath/dry heath</b>	18 (20)	27.83
<b>Wet heath/acid grassland</b>	3 (3)	5.78
<b>Dry heath/calcareous grassland</b>	2 (2)	9.3

The total area of wet heath affected by bracken encroachment is almost 30 hectares and the total of affected dry heath is similar (see table 2). A further 28 hectares of wet heath/dry heath mosaic and nine hectares of dry heath/calcareous grassland mosaic are also affected. If the habitat mosaic polygons are split equally between different habitats, the total amount of affected wet heath is 45 hectares and of affected dry heath is almost 47 hectares.

Bracken density was very variable (see table 3, map 1). Bracken was absent from parts of the western slope and sparse in others but there were also many dense patches. Almost half of the polygons were in the patchily dense category, a quarter was in the sparse category and 28% were in the dense or continuously dense category. Dense and continuously dense patches were usually small and sharply delineated and were only rarely considered to be invading.

**Table 3.** The number of bracken polygons in different density categories. Percentages are given in brackets. Percentages do not add up to 100 as some polygons contain two density categories.

	<b>Number of polygons</b>
<b>Sparse</b>	26 (29)
<b>Patchily dense</b>	43 (47)
<b>Dense</b>	21 (23)
<b>Continuously dense</b>	5 (5)

Sixty-one percent of polygons were assessed as stable and thirty-six percent were considered to be healthy and potentially invading (see table 4, map 2). Most of the bracken found was quite small and bracken height never exceeded one metre. While there were some yellowing fronds, there was little evidence of disease and most fronds looked healthy.

**Table 4.** The number of bracken polygons in different vigour categories. Percentages are given in brackets.

	<b>Number of polygons</b>
<b>Stable</b>	57 (61)
<b>Invading</b>	34 (36)

Half of all the polygons were accessible by quad bike (see table 5). A quarter of all polygons were considered to be accessible to pedestrians only and the remaining quarter were roadside locations, which were accessible to road traffic. None were classed as inaccessible.

**Table 5.** The number of bracken polygons in different accessibility categories.

	<b>Number of polygons</b>
<b>Roadside</b>	22 (24)
<b>Quad</b>	45 (49)
<b>Pedestrian</b>	24 (26)
<b>Inaccessible</b>	0

## **4 DISCUSSION**

### **4.1 Bracken distribution and expansion**

Bracken is locally abundant on the steeper western slopes of the site. Many of the dense stands are sharply delineated from surrounding vegetation but some have fuzzy boundaries and bracken fronds can be scattered within wet and dry heath areas. Bracken is most abundant on steeply sloping stream sides, in shallow, sheltered hollows and on boulder slopes. It is scarce to absent from wetter areas and more exposed ridges between flushes.

It is likely that bracken expansion is limited by climatic conditions at this site and the species is unlikely to invade more exposed areas, even at low altitude. Boundaries of such exposed areas are often sharply outlined and bracken does not appear to spread beyond these boundaries. There are, however, many sparse and more patchily dense patches where dense stands are connected by scattered bracken (see photos 5 and 6), and it is in such areas that expansion will be most likely.



Photo 5. Patchily dense bracken in polygon 81 which might be expanding. (Photo ID B120).



Photo 6. Patchily dense bracken in polygon 65 which might be expanding (Photo ID B73)

Wet heath is the most widespread and abundant habitat within the Ben Hope SSSI and it is very variable. Wet heath on the west-facing slopes contains abundant *Molinia caerulea* and dwarf shrubs such as *Calluna vulgaris*, *Myrica gale* and *Erica tetralix*, usually on deeper, but fairly well-drained soils. This is quite different from

wet heath in most other parts of the site which is dominated by *Trichophorum cespitosum* over a layer of *Racomitrium lanuginosum* or *Cladonia* lichens on thin, stony soils. Such wet heaths are unlikely to be affected by bracken encroachment in the future. Wetter and more flushed wet heaths with a deeper layer of *Sphagnum* species and a high degree of waterlogging which are found locally in the northern part of the site are equally unlikely to be affected. All the potentially invading bracken stands are confined to *Molinia*-rich wet heaths on the west-facing slope.

Dry heath at low altitude is potentially more at risk from bracken encroachment than wet heath. It is less widespread and often only forms small stands on steeper slopes, stream banks and below cliffs, but many of these stands on the west-facing slope support scattered bracken. Bracken density could increase in such stands and partially replace the dry heath habitat. The percentage of dry heath affected by bracken encroachment is higher than that of wet heath, but a precise total is difficult to quantify. Visual estimates of the dry heath habitat on the west-facing slope suggests that as much as 25 percent of dry heath below 350 metres may be affected but much of the dry heath habitat within the Ben Hope SSSI is at higher altitude. The steep dry heath slopes of the main Ben Hope massif, the eastern corries, Creag Riabhach and Creag Riabhach Mhor are all above 350 metres and show no sign of bracken encroachment.

It is difficult to calculate the magnitude of the bracken encroachment problem, due to a lack of accurate information about the total extent of different habitats within the site. The SNH Upland database (Upland SSSI Lists of NVC and other habitat types with areas 1 May 2009 – Ref A253824) lists 720 hectares for wet heath and 320 hectares for dry heath for the site, but these are likely to be substantial underestimates. The map used for these estimates is incomplete, missing out large areas of wet heath in the north and south of the site and showing hardly any dry heath below 350 metres, though this habitat is present on steeper slopes.

If the habitat totals from the upland database are used for calculating percentages, the amount of wet heath affected by bracken encroachment is 6% and for dry heath it is almost 15%. As three quarters of bracken polygons only have a sparse or patchily dense cover of bracken, the total area affected is actually lower than this. This suggests that bracken encroachment within wet heath is currently at levels not considered a threat. For dry heath encroachment levels are higher but once the patchy cover of bracken within the heath is taken into account, the overall total is unlikely to be above 10%.

#### **4.2 Bracken monitoring and control**

As well as considering potential forms of bracken control, bracken distribution should be monitored at this site to check for any possible expansion. This could be done by repeating a selection of the fixed point photographs. Several of these were taken from the roadside, so repeating them would not take much time. Alternatively, aerial photos or satellite imagery could be used. The aerial photos supplied for this survey were not suitable, as it was not possible to distinguish stands of bracken from stands of *Myrica gale*. The latter is also locally abundant in wet heath on the lower west-facing slopes of the site. Aerial photos taken at a different time of year may show differences more clearly.

Satellite images would probably be the easiest way to monitor bracken stands in the future. The stands seem to show up easily on satellite images, though this would need to be investigated further. There is currently an SNH trial project ground-

truthing habitat information derived from satellite imagery (Environment Systems 2011 *in prep*) and this may yield useful information.

Repeating at least some of the fixed point photographs would also be useful. One photo taken in 2004 (Morris 2005) shows the extent of bracken stand 78 and there appears to have been no bracken expansion from this stand in the last seven years (see photos 7 and 8. Repeat photographs should be taken in autumn, once the bracken has turned colour to make stands show up more clearly on the monitoring photos. Distant stands on the photos taken in July 2011 are difficult to separate from other ferns or *Myrica gale*.



Photo 7. View of bracken stand along stream on west slope of Ben Hope below Leitir Mhuseil, 2004. (Photo BH51, taken at NC46266 46836 on 5/8/04).



Photo 8. View of bracken stand along stream on west slope of Ben Hope below Leitir Mhuseil, 2011. (Photo B116, taken at NC46271 46872 on 28/7/11).

If stands are shown to be expanding at this site, some form of bracken control should be considered. Due to the sensitivity of the affected habitat, the options for bracken control are limited. Dwarf shrubs are locally abundant within the dry and wet heaths affected by bracken encroachment so any form of intense physical eradication involving crushing, ploughing or trampling by increasing stocking rates is likely to also adversely affect the dwarf shrub layer. Dense stands could be cut manually, especially if they are close to the road and easily accessible.

Chemical control by spraying with the herbicide Asulam can be a cost-effective and less destructive means of controlling bracken, (SEARS 2008), though there can be problems with run-off and waste and it is not recommended for scattered bracken. Asulam is, however, being withdrawn from sale and may not be licensed for use after 2012, so other options need to be considered. Furthermore, the impact of applying herbicide to the vegetation must be evaluated carefully to avoid damage to non-target species such as other plant species, associated insects and potential ground nesting birds. Buffer zones are required for waterbodies and sensitive habitats..

Most of the more isolated bracken stands in the northwest part of the site are accessible by quad bike which would facilitate access. Slopes are usually steeper in the central and southwest part of the site and stands here are only accessible by quad bike if they are close to the road.

Whether cutting or spraying is chosen, it is important to repeat the method at the suggested intervals to prevent re-establishment of bracken in the cleared areas.

## **5 CONCLUSION**

Bracken encroachment is not yet considered a threat to the Ben Hope SSSI as the area affected is considered to be less than 10% of any of the assemblage components, though there is a degree of uncertainty in this due to the lack of robust baseline data for total habitat extent. This is contrary to the results from the Site Condition Monitoring survey (Maier 2011) which suggested that bracken encroachment levels for dry heath were above 10%. This is now considered to be an overestimate, based on the present more detailed survey of bracken extent and distribution.

## **References**

MacDonald A. Stevens P, Armstrong H., Immirzi P and Reynolds P. 1998. *A Guide to Upland Habitats, Surveying Land Management Impacts. Part 1 and 2.* Scottish Natural Heritage, Battleby.

Maier, R.T 2011. Site Condition Monitoring Survey of Upland and Peatland Notified Features on Designated Sites: Ben Hope SSSI, Ruth Maier, SNH report

Morris, J 2005. Assessment and evaluation of herbivore impacts on Ben Loyal and Ben Hope. SNH unpublished report, Scottish Natural Heritage, Edinburgh.

SNH Information and advisory note 24. Bracken control.  
<http://www.snh.org.uk/publications/on-line/advisorynotes/24/24.htm>

SEARS 2008. Bracken control. A guide to best practice.

**Aerial imagery**

Next Perspectives 2004. Aerial Imagery licensed to Scottish Natural Heritage under the PGA, through Next Perspectives

## **Appendix 1 Maps**

Available to download separately from the SNH website.

## Appendix 2. Data Tables

### 2 a) Bracken data table

**Density categories:** S – sparse, PD – patchily dense, CD – continually dense. Four of the larger polygons contain two density categories separated by a '/', as there was insufficient information to split them. **Vigour categories:** H – apparently healthy and invading, S – apparently stable. **Understorey:** WH – wet heath, DH – dry heath, AG – acid grassland, CG – calcareous grassland. If two understorey categories are present they are separated by '/'. Brackets are used in the habitat category if small patches of one habitat are present within the other. **Access:** P – pedestrian, V – roadside, Q – quad bike.

ID	Density	Vigour	Understorey	Access	Photo id	Comments
1	D	S	WH/AG	P	B1, B2, B3, B4, B5	
2	PD	H	DH/CG	P	B1, B2, B3, B4, B5	At base of cliffs above treeline
3	PD	S	WH	V	B1, B2, B3, B4, B5	
4	PD	S	WH	V	B1, B2, B3, B4, B5	3 small patches close together
5	PD	H	WH	V	B6	3 small patches.
6	PD	H	WH	Q	B6	
7	PD	H	WH	V	B6	
8	D	H	AG	P	B7	Within trees
9	D	S	WH	Q	B8	4 linear patches occupying hollows.
10	D	S	WH	Q	B8	4 linear patches occupying hollows.
11	D	S	WH	V	B8	4 linear patches occupying hollows.
12	D	S	WH	V	B8	4 linear patches occupying hollows.
13	PD	H	WH/DH	Q	B9, B10	Long linear patch on edge of woodland
14	S	H	WH/AG	V	B9	On road bank
15	S	H	DH	P	B11	Diffuse new growth colonising DH
16	PD	H	WH	P	B12	Small patch on edge of forestry
17	PD	H	WH	Q	B13, B14	Small patches.
18	PD	H	WH	Q	B13, B14	Small patches.
19	PD	H	WH	Q	B13, B14	Small patches.
20	PD	H	WH	Q	B13, B14	Small patches.
21	PD	H	WH	Q	B13, B14	Small patches.
22	PD	H	WH	Q	B13, B14	Small patches.
23	S	S	DH	P	B15	
24	D	H	WH	Q	B13, B14	Small patches.
25	CD	H	WH	Q	B16	
26	PD	H	DH	P	B17, B18	
27	S	H	WH	V	B19	V small diffuse patch
28	S	S	WH	V	B20	Small diffuse patch.
29	S	S	WH	V	B21	Small diffuse patch.
30	S	S	DH	Q	B22	Small diffuse patch.
31	D	S	WH	Q	B23	Small diffuse patch.
32	D	S	WH	Q	B24	
33	D	S	WH	Q	B25	Dense patch in woodland gap
34	D	S	WH	Q	B26	Small patch on edge of woodland.
35	S	H	WH	Q	B27	Small diffuse patch.
36	S	H	WH	Q	B28	Small diffuse patch.
37	D	S	WH	Q	B29	Small patch on edge of woodland.

38	D	S	WH	Q	B30	Small dense patch.
39	D	S	WH	Q	B31	Small dense patch.
40	D	S	WH	Q	B32	Small patch on edge of woodland.
41	S	H	WH	Q	B33	Small diffuse patch.
42	D	S	WH	Q	B34	Small patch on edge of woodland.
43	D	S	WH	V	B35	
44	D	S	WH	V	B36	
45	PD	H	AG	V	B37, B38	
46	D	S	WH/DH	Q	B39	
47	PD	S	DH	Q	B40, B41, B42	on steep bank above stream, some fronds yellowing
48	PD	S	WH	Q	B43	
49	PD	S	DH	Q	B44	on stream bank with some birch and willow
50	PD	S	WH/DH	Q	B45, B46, B47, B48, B49, B50, B51, B52, B53, B54, B55	scattered to patchily dense below woodland and around rocks, very sparse west of stream
51	S	S	DH	Q	B56	
52	S	S	DH/WH	Q	B57	scattered around outcrop
53	S	S	DH	Q	B58, B59, B60	stream valley sides, mostly dry heath, scattered trees
54	PD	S	DH	Q	B61, B62, B63	sparse on steeper slopes within stream valley
55	S/PD	S	DH/WH	P	B64, B65	sparse and patchy mainly round rocks, scattered through heath, mostly mid-slope
56	S	S	DH	Q	NONE	scattered in heath and crags above track, but localised
57	S	H	DH	Q	B66	Beginning to colonise DH below small cliff
58	S	S	WH	Q	NONE	small sparse stand on stream side
59	S	S	WH	Q	B67	scattered bracken in wet heath
60	PD	S	WH	P	B68	some dense patches close to stream
61	PD	S	WH	Q	B68	frequent small patches along stream margin
62	PD	H	WH	P	B69	
63	PD	S	DH	P	B70, B71	steep banks of stream only, not continuing into wet heath above
64	PD	S	DH	P	B72, B73, B74	on sides of stream with scattered birch
65	S	S	DH/WH	P	B72, B73, B74	scattered in wet and dry heath below cliffs
66	CD	S	WH/DH	P	B69	
67	CD	S	WH/DH	P	B69	
68	CD	S	WH/DH	P	B69	sharply delineated stands on upper slope difficult to map precisely, associated with hollows and flushes
69	S/PD	S	WH/DH	P	B75, B76,	fronds healthy but short and limited to sheltered hollows and flush sides
70	PD	S	DH (WH)	P	B77, B78, B79	
71	PD	S	DH/WH	Q	B80, B81, B82, B83, B84, B85,	

					B86, B87, B88	
72	S	H	DH	P	B89, B90, B91, B92, B93, B94, B95	sparse in Dh on steep upper slope, mostly short but should be monitored for expansion
73	PD	S	WH	P	B96, B97	dense stands on either side of flush lines and hollows, scattered to absent in between
74	PD	H	WH	V	B98, B99, B100, B101, B102, B103	mostly sharply defined stands within WH close to road, also some more scattered fronds - possible expansion in these stands should be monitored
75	S	H	WH	Q	B98, B99, B100, B101, B102, B103	scattered in wet heath
76	PD	H	WH/DH	P	B105, B106 B109, B110	over boulders
77	D	H	WH	V	B112, B113	
78	D	S	DH/WH	P	B114, B115, B116, B117	dense bracken along stream, angling up to lower cliffs, connects to large PD polygon across boulder slope, and gives way above to grassy strip below cliffs
81	S/PD	H	WH	V	B119, B120	patches 30%, possibly increasing here
82	PD	S	WH/DH	V	B121	patches less than 5% within outcrop area
83	PD	S	DH	V	B122	bracken within patches of gorse
84	S/PD	H	DH/WH	V	B123, B124	patches, 20% of total, possibly increasing here
85	PD	S	DH	P	B125	very small patches, only 1% of polygon
87	CD	S	WH	Q	B128	
88	CD	S	AG	V	B129	
89	PD	H	AG (WH)	V	B130, B131	
90	S	H	DH	Q	B132	Sparse, <i>Betula pubescens</i> colonising
91	PD	S	WH/DH	V	B133	
92	PD	S	WH	Q	B134	
93	S	S	DH	P	B135, B136	10% cover of polygon, some aspen
94	PD	S	DH (WH)	Q	B137, B138	some fronds yellowing

**2b) Bracken photo table**

Photo ID	Northing	Easting	Direction	Surveyor	Polygon ID
B1, B2, B3A, B3B, B3C	246334	946818	90, 0	CW	1
B1, B2, B3A, B3B, B3C	246334	946818	90, 0	CW	2
B4 (B3A, B3B, B3C)	246287	946640	90, 0	CW	3
B5 ( B3A, B3B, B3C)	246210	946456	90, 0	CW	4
B6	246263	946287	180	CW	5
B6	246263	946287	180	CW	6
B6	246263	946287	180	CW	7
B7	246263	946287	90	CW	8
B8	246154	946176	90	CW	9
B8	246154	946176	90	CW	10
B8	246154	946176	90	CW	11
B8	246154	946176	90	CW	12
B9, B10	246065	945963	90	CW	13
B9	246065	945963	90	CW	14
B11	no GR	no GR	90	CW	15
B12	no GR	no GR	90	CW	16
B13, B14	245833	945657	90	CW	17
B13, B14	245833	945657	90	CW	18
B13, B14	245833	945657	90	CW	19
B13, B14	245833	945657	90	CW	20
B13, B14	245833	945657	90	CW	21
B13, B14	245833	945657	90	CW	22
B15	246282	945366	50	R	23
B13, B14	245833	945657	90	CW	24
B16	246282	945366	180	R	25
B17, B18	246282	945366	0, 230	R	26
B19	246220	952520	135	CW	27
B20	246220	952520	135	CW	28
B21	246220	952520	90	CW	29
B22	246145	952828	135	CW	30
B23	246182	952661	270	CW	31
B24	246143	952813	270	CW	32
B25	246258	953364	135	CW	33
B26	246303	953478	135	CW	34
B27	246306	953502	135	CW	35
B28	246306	953502	135	CW	36
B29	246306	953502	135	CW	37
B30	246234	953382	270	CW	38
B31	246192	953454	270	CW	39
B32	246195	953462	0	CW	40
B33	246306	953502	315	CW	41
B34	246195	953462	45	CW	42
B35	246928	954240	135	CW	43
B36	246952	954286	270	CW	44
B37	246994	954350	90	CW	45
B38	246987	954330	270	CW	45
B39	246967	954309	90	CW	46
B40, B41, B42	246157	952934	50, 40, 20	R	47
B43	246188	952926	5	R	48
B44	246384	952926	280	R	49

<b>Photo ID</b>	<b>Northing</b>	<b>Easting</b>	<b>Direction</b>	<b>Surveyor</b>	<b>Polygon ID</b>
B45, B46, B47, B48, B49	246493	952831	panorama from 90 clockwise to 0	R	50
B50, B51	246691	953062	30, 10	R	50
B52	246767	953191	290	R	50
B53, B54, B55	246727	953344	170, 180, 190, 230	R	50
B56	246872	953133	205	R	51
B57	247171	953679	120	R	52
B58, B59, B60	247181	953161	205, 140, 80	R	53
B61, B62, B63	246372	952735	90, 135, 160	R	54
B64, B65	246466	952208	180	TR	55
B66	246362	951584	90, 0	CW	57
B67	246269	947677	190	R	59
B68	246214	947653	60	R	60
B68	246214	947653	60	R	61
B69	246214	947653	80	R	62
B70, B71	246539	948168	0, 90	R	63
B72	246475	948003	90	R	64
B73, B74	246289	947876	60, 10	R	64
B72	246475	948003	90	R	65
B73, B74	246289	947876	60, 10	R	65
B69	246214	947653	80	R	66
B69	246214	947653	80	R	67
B69	246214	947653	80	R	68
B75, B76,	246470	947760	90, 120	R	69
B77, B78, B79	246025	947622	280, 260, 230	R	70
B86, B87, B88	246509	947248	90, 135, 180	R	71
B89, B90, B91, B92, B93, B94, B95	246470	947760	panorama from 90 to 180 degrees	R	72
B96, B97	246212	947653	110, 130	R	73
B98, B99, B100, B101, B102, B103	246324	947305	panorama from 0 to 180 degrees	R	74
B98, B99, B100, B101, B102, B103	246324	947305	panorama from 0 to 180 degrees	R	75
B105, B106 B109, B110	246326	947222	panorama from 45 to 135 degrees	R	76
B112, B113	246323	947070	110, 170	R	77
B114, B115	246295	946913	60, 130	R	78
B116, B117	246271	946872	80, 130	R	78
B119	245810	948379	140	TR	81
B120	245810	948379	140	TR	81

<b>Photo ID</b>	<b>Northing</b>	<b>Easting</b>	<b>Direction</b>	<b>Surveyor</b>	<b>Polygon ID</b>
B121	245811	948885	0	TR	82
B122	245998	948190	90	TR	83
B123	246301	947880	0	TR	84
B124	246301	947880	0	TR	84
B125	246046	948329	20	TR	85
B128	246204	947765	90	TR	87
B129	246301	947880	270	TR	88
B130	246017	950806	180	TR	89
B132	246081	951143	90	TR	90
B133	245877	950806	0	TR	91
B134	246315	947826	200	TR	92
B135	246561	950842	170	TR	93
B136	246561	950842	170	TR	93
B137	247833	952763	135	TR	94
B138	247833	952763	270	TR	94

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