

**RESTORING RAISED BOG IN IRELAND**  
**Project Reference: LIFE04 NAT/IE/000121**

**A REPORT ON THE RESTORATION OF PROJECT SITE No. 2**

**CAMDERRY BOG, Co. GALWAY**



**Compiled by: John Derwin,  
Project Ecologist,  
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## Project Site No. 2 - Camderry Bog, Co. Galway

### 1. Introduction

<b>Grid Reference</b> IM 6999 5790	<b>Elevation (m)</b> 80	<b>Bedrock Geology</b> <b>Limestone</b>
<b>SAC Name and Number</b> Camderry Bog cSAC (2347)	<b>Project Site Area (ha)</b> 13.8	<b>Main Restoration Methods</b> Clear-fell mature conifer crop Wind-row remaining brash Block drains with peat dams Control natural regeneration
<b>SAC Area (ha)</b> 281		
<b>Area of Conifer Cover (ha)</b> 13.8	<b>Area of Open Bog (ha)</b> 0	<b>Area of Birch Woodland (ha)</b> 0
<b>Noteworthy habitats/ plant/animal species present</b> Red Grouse a Red listed species has been recorded on adjoining open bog		

### General site description

Camderry Bog is part of a cluster of bogs situated 9 km south-east of Glenamaddy, Co. Galway. The site comprises a relatively large raised bog that includes both areas of high bog and cutover bog. The northern and western margins of the bog are bounded by the Shiven River, the eastern margin is bounded by a mineral ridge and the southern margin is bounded by roads (NPWS, 2002). There is a substantial area of forestry planted on high bog in the northern section of this bog (Conaghan, 2003).

The site consists of two domes separated by a broad mineral ridge. Overall the northern dome appears to be quite dry with limited areas of wet hummock/hollows. The southern dome contains an area of quaking bog with hummocks and tear pools. A small flushed area showing small-scale hummock/hollow development is found on the northern dome to the north of the forestry plantation on the high bog. To the east there is an extensive flush with areas of open water. Cutover bog occurs all around the margins of the high bog apart from a semi-natural margin to the north along the Shiven River (NPWS, 2002).

Much of the high bog has vegetation typical of the Western Raised Bog type, consisting of Ling Heather (*Calluna vulgaris*), Cottongrass (*Eriophorum* spp.) and Carnation Sedge (*Carex panicea*). Bog mosses (*Sphagnum* spp.) form a spongy mat in places, but due to damage from drying out and burning are rarely present as carpets. Over large areas, especially in the south, lichens (*Cladonia* spp.) occur in abundance. Hummocks of the moss *Racomitrium lanuginosum* occur in the centre of the site and the liverwort *Pleurozia purpurea* is also present. The area of quaking bog has hummocks and hollows and is characterised by hummocks formed of the bog mosses *Sphagnum papillosum* and *S. capillifolium*, extensive lawns of *S. cuspidatum* with Bogbean (*Menyanthes trifoliata*) and tear pools. There are Bog Asphodel (*Narthecium ossifragum*) dominated hollows and the moss *Campylopus atrovirens* occurs at the margins of the tear pools. This area supports the rare species of bog moss *S. fuscum* and *S. imbricatum* (NPWS, 2002).

In the flushed areas low hummocks of *S. capillifolium* and *S. imbricatum* occur with Bog Asphodel lawns and abundant Cranberry (*Vaccinium oxycoccos*). The large eastern flush consists of a depression with open water and the bog moss *S. cuspidatum* around the margin. Other species present include Soft Rush (*Juncus effusus*), Bogbean and the Cotton-grasses (*Eriophorum angustifolium* and *E. vaginatum*).

The old cutover is mainly dominated by Ling Heather, Purple Moor-grass (*Molinia caerulea*), Soft Rush and Cotton-grasses. Common Gorse (*Ulex europaeus*), Birch (*Betula* spp.) and Willows (*Salix* spp.) also occur along the drains. Along the northern margin of the site, on the banks of the Shiven River, Hawthorn (*Crataegus monogyna*), Willow and Ling Heather grow along with typical river bank species such as Meadow-sweet (*Filipendulia ulmaria*), Nettle (*Urtica dioica*) and Docks (*Rumex* spp.). An area of cutover to the east of the site is water-logged by water discharging from the high bog. Drains in this cutover contain species indicative of some enrichment such as Bog Pondweed (*Potamogeton polygonifolius*) and Bottle Sedge (*Carex rostrata*). To the south, old cutover is very wet and regenerating well, with a good cover of bog mosses, including *S. papillosum*, *S. capillifolium* and *S. auriculatum*. Purple Moor-grass and Cotton-grasses dominate over the carpet of bog mosses (NPWS, 2002).

Current landuse on the site consists of peat-cutting around the margin of the high bog and forestry. In common with all raised bog sites in Ireland, most of the marginal areas of the site have been subject to peat-cutting in the past and this has resulted in the drying out of the adjacent high bog. Active peat-cutting is carried out to the south, east and north-west of the site. An area of conifers has been planted on the western side of the northern bog section and this has resulted in the direct loss of raised bog vegetation and is also causing the drying out of the adjacent high bog. In spite of this afforestation, the peat surface of this plantation is still remarkably wet. Damaging activities associated with these land uses include drainage and extensive burning of the high bog. These activities have resulted in loss of raised bog habitat and damage to the hydrological status of the site and pose a continuing threat to its viability (NPWS, 2002).

### **Project Site Description (Pre-restoration)**

The project area consists of 13.8 hectares of conifer plantation, planted on high bog. The site was surveyed in 2003, prior to restoration, which found that these conifers consisted largely of Lodgepole Pine (*Pinus contorta*) with a small test plot of Sitka Spruce (*Picea sitchensis*). Although the conifers formed a closed canopy, some bog vegetation remained on the wet bog surface with a high *sphagnum* moss cover still evident in places. In general, planted trees had grown well on the high bog of this site. In parts of the western half of the plantation however tree growth did not appear to be as good (Conaghan, 2003).

### **Description of bog vegetation adjoining planted areas**

This large planted block adjoins intact raised bog dominated by species such as Ling Heather (*Calluna vulgaris*), Hare's tail Cotton-grass (*Eriophorum vaginatum*), Deer-grass (*Trichophorum cespitosum*) and Bog Asphodel (*Narthecium ossifragum*). Other frequent species include Bog Rosemary (*Andromeda polifolia*), Cross-leaved Heath (*Erica tetralix*), Common Cotton-grass (*Eriophorum angustifolium*), the lichen *Cladonia portentosa* and the mosses *Sphagnum capillifolium* and *S. papillosum*. This bog is wet in places and there are numerous bog pools on the high bog immediately to the south-east of the plantation. Immediately to the north of the main forestry block there is a zone (10-15m wide) of Lodgepole Pine regenerating on the bog (Conaghan, 2003).

### **Regenerating conifers at plantation margin on Camderry Bog**



### **Restoration Actions**

At this site the main restoration measures undertaken were the clear-felling and removal of the mature conifer crop, wind-rowing of the remaining brash and blocking of drains with peat dams, to raise water-levels. Follow-up work included the control of the natural regeneration of conifer seedlings. Lodgepole pine regenerating on the open bog surface were also be felled as part of this project.

## **2. Methods**

Prior to the start of restoration activities at the site, the habitats and vegetation occurring was surveyed and described (Conaghan, 2003). During the initial restoration work of 2005, permanent quadrats were established on each of the vegetation types within the project site.

During the field survey, particular attention was paid to the possible occurrence of plant and animal species which are considered to be rare in both a national and local context with particular emphasis on animal species listed in Annex II of the E.U. Habitats Directive and plant species listed in the Irish Red Data Book for vascular plants (Curtis and McGough, 1988), the 1999 Flora Protection Order and Annex II of the E.U. Habitats Directive.

### **3. Site Photographs**

In order to show the restoration activities which have taken place at this site, a number of photographs are presented in the following pages. These include photographs taken by the Project Ecologist in order to illustrate the vegetation descriptions and changes in the habitats/vegetation present over time.

### **4. Vegetation of Project Site**

The vegetation of the project site was previously dominated by tall, closed-canopy coniferous plantation. As a result most of the ground flora was dominated by a thick layer of Lodgepole Pine needles with generally little bog vegetation present apart from scattered clumps of the mosses (mainly *Hypnum cupressiforme* and *Sphagnum capillifolium*). However, in the western half of the plantation where tree growth had not been as good and there were significant areas with a high cover of *Sphagnum* mosses and the lichen *Cladonia portentosa* (Conaghan, 2003).

#### **Ground flora dominated by pine needles under conifer plantation on Camderry Bog**



## **5. Changes in Overall Vegetation/Habitat Cover**

Much of the site is now cleared of conifers and brash. The brash which remained after clear-felling has been wind-rowed to allow bog vegetation to re-colonise the exposed peat surface. With the removal of conifers and blocking of drains, water-levels generally remained within 10cm of the bog surface throughout the year, which allowed for the colonisation of *Sphagnum* mosses.

## **6. Vegetation Monitoring Quadrats**

The vegetation changes which have taken place within the site over the period of the restoration project are shown by means of observed changes in permanent quadrats. Three 10x10m permanent quadrats were installed on this site, which were described and photographed to monitor changes in vegetation over time. In order to ensure the future position of quadrats the corners have been marked with short stakes and an 8-figure GPS reading was also recorded. Vegetation tables for the quadrats are presented below.

**Quadrat 1:** This quadrat was located towards the southern margin of the plantation and occurred under closed canopy conifers with a ground cover containing *Hypnum* and some *Sphagnum* moss, but mainly consisted of pine needles. With the felling of the conifers and blocking of drains, it can be seen that Ling Heather, Cotton-grasses and *Sphagnum* cover increased along with Willow-herb. There is some natural regeneration of conifer seedlings, which needs to be controlled. Over time, if conditions remain wet, *Sphagnum* cover will increase further, Willow-herb will die out and raised bog habitat will be established.

## Camderry Quadrat 1

Area: 10 x 10m

Location: 30m East W1

Grid Ref: N7028 5765

Altitude: 86m

Bog Type: Highbog

Ecotope: NA

Slope: Slight

Aspect: NE

Landuse: Forestry

Management: Clearfell

Date	23/08/2005	31/08/2006	22/08/2007	31/07/2008
Firmness	Soft	Soft	Soft	Soft
Drains	Yes	Yes	Yes	Yes
Canopy Cover %	2	0	0	0
Canopy Height	0	0	0	0
Vegetation Cover %	33	80	75	70
Vegetation Height (m)	30	30	30	50
Dwarf Shrub Cover %	0	5	15	15
Herb Cover %	0	40	30	55
Bryophyte Cover %	33	80	75	55
Sphagnum cover %	11	25	20	25
Open Water %	5	5	2	0
Brash cover %	50	30	30	20
Pine Needle cover %	10	0	0	5
Pine Needle Depth cm		0	0	1
Bare Peat %	0	5	0	5
Species number	6	19	23	21
<i>Pinus contorta</i>	2	5	5	10
<i>Picea sitchensis</i>		10	1	2
<i>Betula pubescens</i>			3	
<i>Salix</i> spp.			1	2
<i>Rubus</i> spp		3	2	1
<i>Digitalis purpurea</i>		1	1	1
<i>Potentilla erecta</i>		1		
<i>Juncus</i> spp		3	2	5
<i>Pteridium</i> spp		1	1	3
<i>Epiobium</i> spp		5	10	10
<i>Vaccinium myrtilus</i>		1	3	3
<i>Calluna vulgaris</i>		5	10	10
<i>Erica tetralix</i>			2	2
<i>Carex panicea</i>			1	1
<i>Eriophorium vaginatum</i>		1	5	15
<i>E. angustifolium</i>				5
<i>Drosera rotundifolia</i>			1	1
<i>Cladonia portentosa</i>			1	
<i>Campylopus atrovirens</i>		5		
<i>C. introflexus</i>		1		
<i>Hypnum jutlandicum</i>	20	50	50	25
<i>Polytricum commune</i>	1	5	3	5
<i>Sphagnum recurvum</i>				5
<i>S. cuspidatum</i>	1	5	2	
<i>S. capillifolium</i>	5	5	5	5
<i>S. papillosum</i>			3	
<i>S. subnitens</i>		10	5	5
<i>S. magellanicum</i>	5	5	5	10



**Quadrat 1, Aug 2008**



**Quadrat 2:** This quadrat was located towards the centre of the plantation and occurred under closed canopy conifers with a ground cover containing some *Sphagnum* moss, but mainly consisted of pine needles and brash. With the felling of the conifers and blocking of drains, it can be seen that Ling Heather, Cotton-grass and *Sphagnum* cover increased along with Willow-herb. There is some natural regeneration of conifer seedlings, which needs to be controlled. Over time, if conditions remain wet, *Sphagnum* cover will increase further, Willow-herb will die out and raised bog habitat will be established.

### **Camderry Quadrat 2**

**Area:** 10 x 10m

**Location:** 40m East W7

**Grid Ref:** N7037 5775

**Altitude:** 80m

**Bog Type:** High Bog

**Ecotope:** NA

**Slope:** Slight

**Aspect:** NE

**Landuse:** Forestry

**Management:** Clearfell

<b>Date</b>	<b>23/08/2005</b>	<b>31/08/2006</b>	<b>22/08/2007</b>	<b>31/07/2008</b>
<b>Firmness</b>	Soft	Soft	Soft	Soft
<b>Drains</b>	Yes	Yes	Yes	Yes
<b>Canopy Cover %</b>	0	0	0	0
<b>Canopy Height</b>	0	0	0	0
<b>Vegetation Cover %</b>	25	40	60	40
<b>Vegetation Height (m)</b>	5	30	30	20
<b>Dwarf Shrub Cover %</b>	0	5	15	10
<b>Herb Cover %</b>	2	5	20	30
<b>Bryophyte Cover %</b>	23	40	60	65
<b>Sphagnum cover %</b>	20	20	25	30
<b>Open Water %</b>	0	0	0	0
<b>Brash cover %</b>	40	50	25	15
<b>Pine Needle cover %</b>	25	10	10	10
<b>Pine Needle Depth cm</b>	10	10	1	1
<b>Bare Peat %</b>	10	5	0	5
<b>Species number</b>	5	10	11	13
<i>Pinus contorta</i>	1			1
<i>Rumex acetosella</i>		1	1	2
<i>Holcus lanatus</i>			1	1
<i>Pteridium spp</i>				1
<i>Epiolobium spp</i>		2	5	10
<i>Calluna vulgaris</i>		5	15	10
<i>Erica tetralix</i>				1
<i>Carex panicea</i>			1	
<i>Eriophorium vaginatum</i>		1	5	15
<i>C. introflexus</i>		5		
<i>Hypnum jutlandicum</i>	3	20	30	30
<i>Polytricum commune</i>		1	5	5
<i>S. capillifolium</i>	10	5	10	5
<i>S. subnitens</i>	5	10	5	10
<i>S. magellanicum</i>	5	5	10	15

**Quadrat 2, Aug 2008**



**Quadrat 3:** This quadrat was located towards the northern margin of the plantation and occurred under closed canopy conifers with a ground cover containing some *Sphagnum* moss, but mainly consisted of pine needles and brash. With the felling of the conifers and blocking of drains, it can be seen that Ling Heather, Cottongrass and *Sphagnum* cover increased. Over time, if conditions remain wet, *Sphagnum* cover will increase further and active raised bog habitat will be established.

### **Camderry Quadrat 3**

**Area:** 10 x 10m

**Location:** 20m South W3

**Grid Ref:** N7041 5782

**Altitude:** 79m

**Bog Type:** High Bog

**Ecotope:** NA

**Slope:** Slight

**Aspect:** NE

**Landuse:** Forestry

**Management:** Clearfell

Date	23/08/2005	31/08/2006	22/08/2007	31/07/2008
<b>Firmness</b>	Soft	Soft	Soft	Soft
<b>Drains</b>	Yes	Yes	Yes	Yes/Blocked
<b>Canopy Cover %</b>	0	0	0	0
<b>Canopy Height</b>	0	0	0	0
<b>Vegetation Cover %</b>	20	45	60	55
<b>Vegetation Height (m)</b>	1	10	30	30
<b>Dwarf Shrub Cover %</b>	0	15	20	20
<b>Herb Cover %</b>	1	6	20	35
<b>Bryophyte Cover %</b>	19	45	60	70
<b>Sphagnum cover %</b>	15	30	35	30
<b>Open Water %</b>	5	5	5	1
<b>Brash cover %</b>	20	15	15	10
<b>Pine Needle cover %</b>	25	35	20	20
<b>Pine Needle Depth cm</b>	5	5	5	5
<b>Bare Peat %</b>	30	0	0	4
<b>Species number</b>	7	12	15	18
<i>Pinus contorta</i>	1			
<i>Betula pubescens</i>				1
<i>Salix</i> spp.			1	1
<i>Rubus</i> spp				1
<i>Juncus</i> spp		1	1	
<i>Molinia caerulea</i>				1
<i>Holcus lanatus</i>		1	1	1
<i>Pteridium</i> spp			1	1
<i>Epiolobium</i> spp		1	1	5
<i>Calluna vulgaris</i>		15	15	15
<i>Erica tetralix</i>			5	5
<i>Eriophorium vaginatum</i>		2	5	15
<i>E. angustifolium</i>		1	5	10
<i>Campylopus atroverins</i>	2	5		5
<i>Hypnum jutlandicum</i>	2	10	20	30
<i>Polytricum commune</i>			5	5
<i>Sphagnum recurvum</i>				5
<i>S cuspidatum</i>	1	5	10	
<i>S. capillifolium</i>	5	5	5	5
<i>S. subnitens</i>	4	10	10	10
<i>S. magellanicum</i>	5	10	10	10

**Quadrat 3, Aug 2008**



## 7. Changes in Water-levels

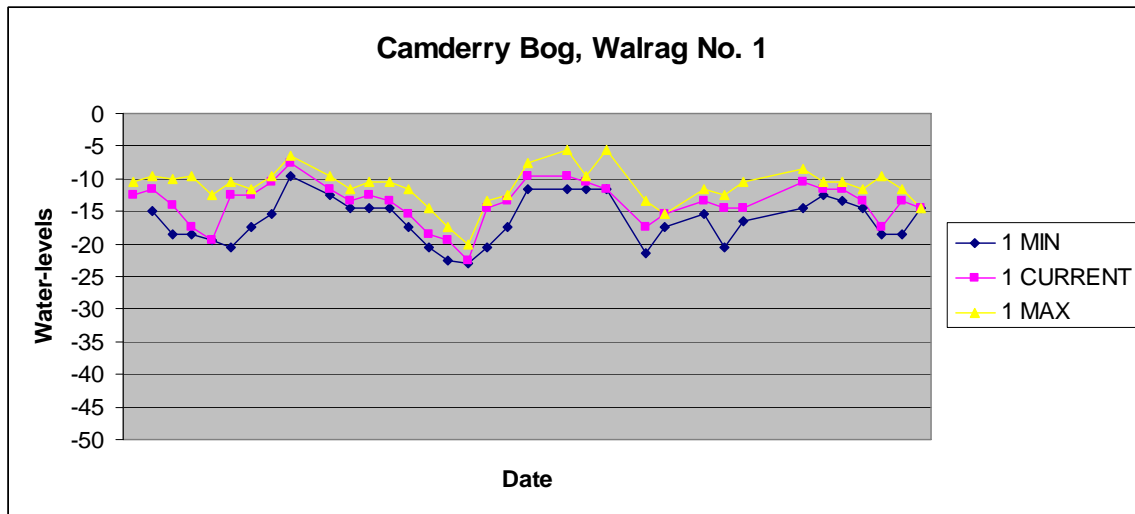
Prior to restoration, Walrags were installed in the conifer plantation to record any changes in water-levels, due to tree removal and drain blocking. With the removal of conifers and drain-blocking, water-levels were found to be maintained within **10cm** of the bog surface. The water-table within the project site remains close to the bog surface throughout most of the year, which will allow active raised bog habitat to establish.

## 8. Hydrological Monitoring (Walrag) Graphs

During the clear-felling operation, eight Walrags were installed on this site to record the changes in water-levels. The high water-levels is clearly seen in the following graphs.

### Camderry Bog Walrag 1

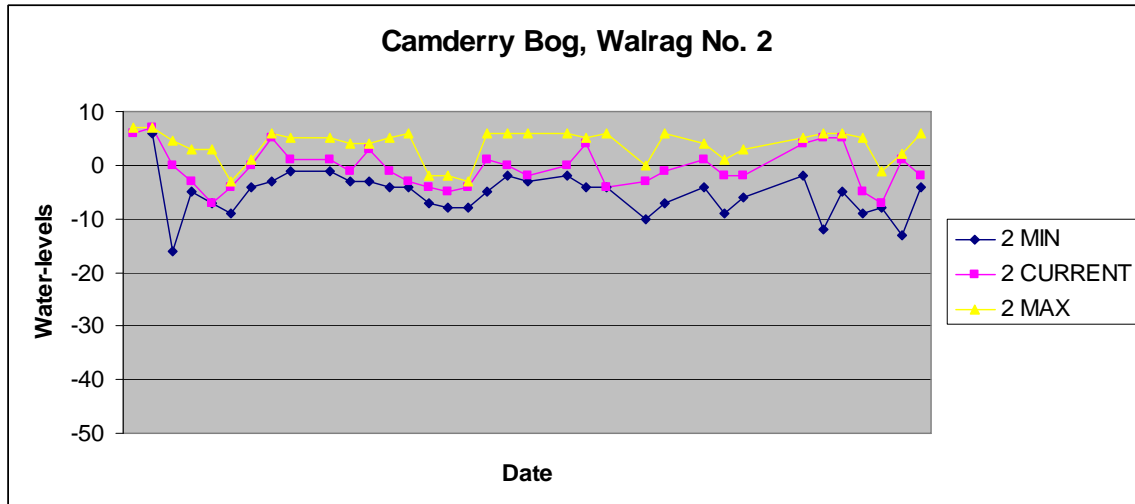
(Clearfell on High Bog, water-levels 10cm below surface post restoration\*, lower in summer)



May 2005 (Installed) \*  
\*Clearfell & Drain-blocking

### Camderry Bog Walrag 2

(Clearfell on High Bog, water-levels within 10 cm of bog surface post restoration\*, lower in summer)

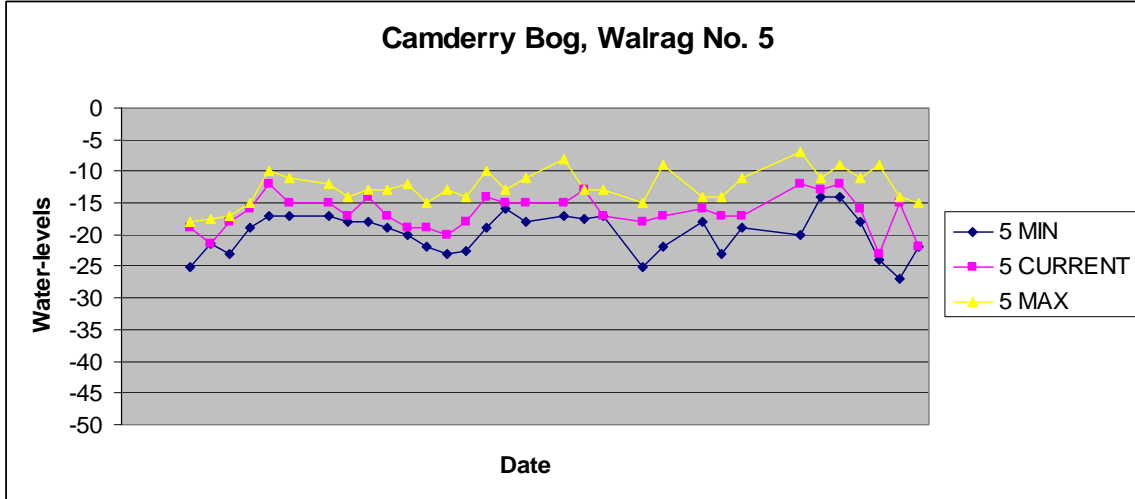


May 2005 (Installed) \*  
\*Clearfell & Drain-blocking



### Camderry Bog Walrag 5

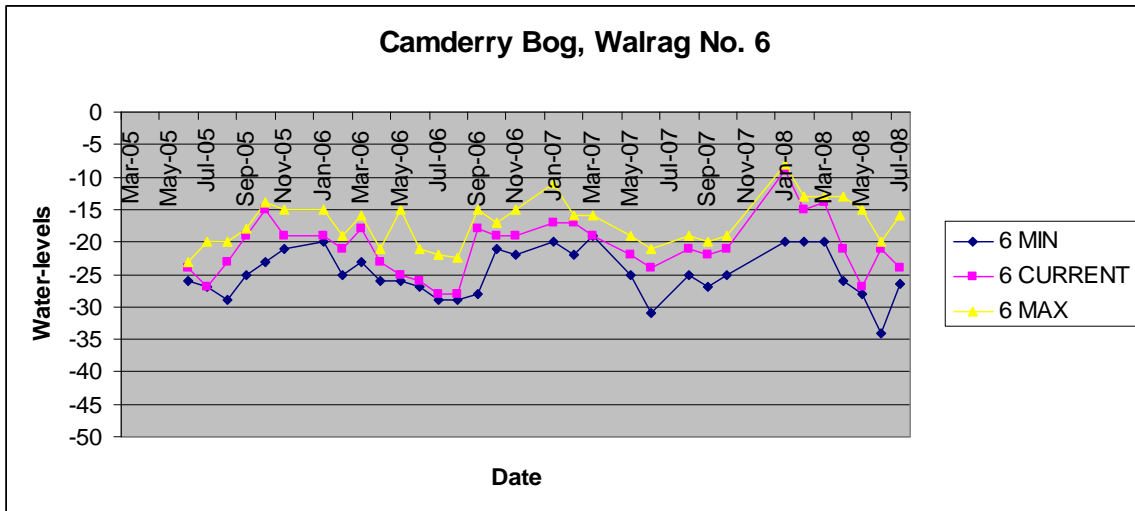
(Clearfell on High Bog, water-levels below 10cm post restoration\*, lower in summer)



May 2005 (Installed) \*  
 \*Clearfell & Drain-blocking

### Camderry Bog Walrag 6

(Clearfell on High Bog, water-levels below 10cm post restoration\*, lower in summer)

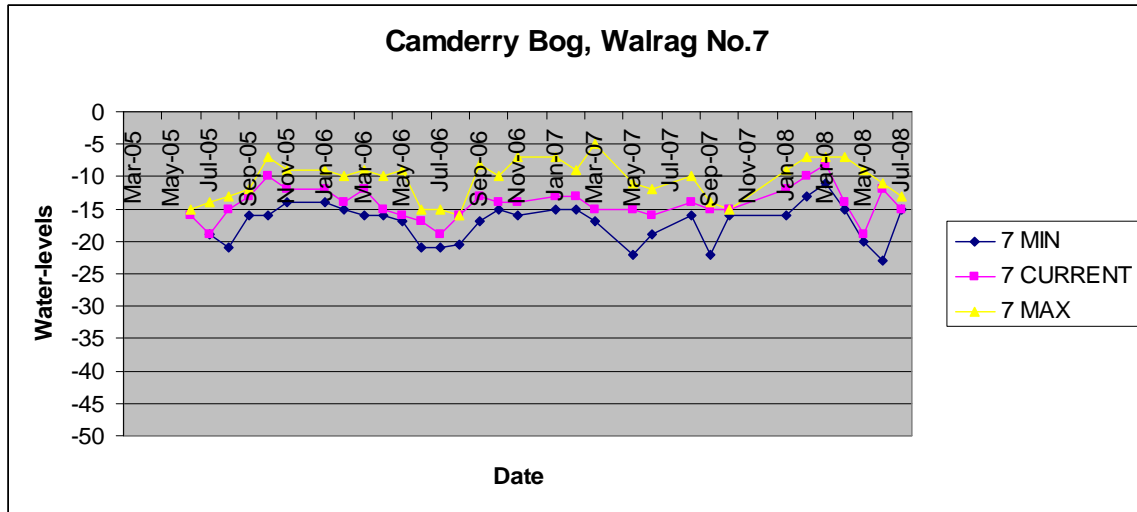


May 2005 (Installed) \*  
 \*Clearfell & Drain-blocking



### Camderry Bog Walrag 7

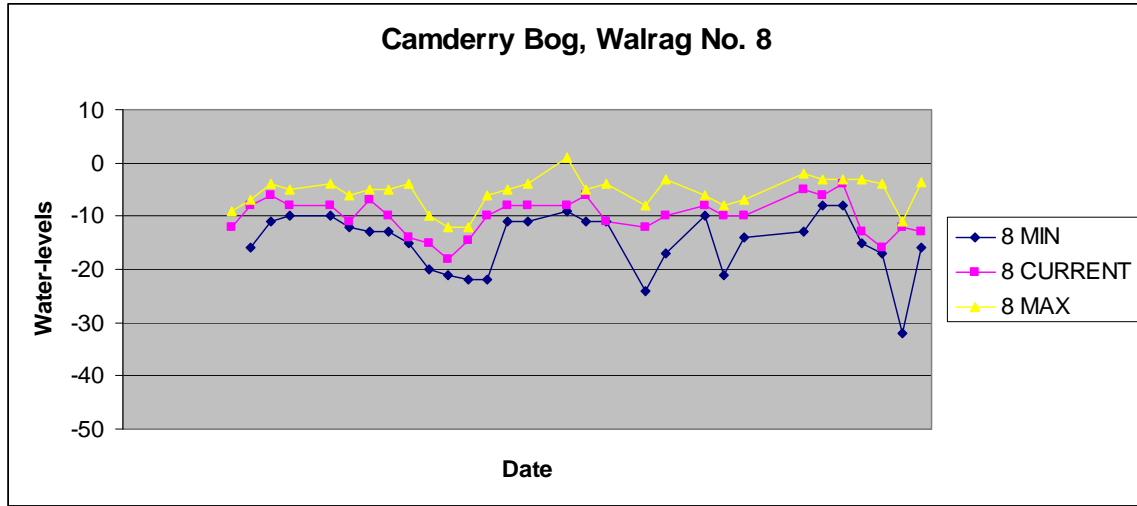
(Clearfell on High Bog, water-levels below 10cm post restoration\*, lower in summer)



May 2005 (Installed) \*                      May 2006                      May 2007                      May 2008  
 \*Clearfell & Drain-blocking

### Camderry Bog Walrag 8

(Clearfell on High Bog, water-levels at 10cm below bog surface post restoration\*, lower in summer)



May 2005 (Installed) \*                      May 2006                      May 2007                      May 2008  
 \*Clearfell & Drain-blocking

## 9. Conclusion

This site is considered to be a very good candidate for bog rehabilitation. The removal of trees from the high bog surface will, over the course of time, lead to a gradual improvement in the condition of high bog in the northern half of this site. There has been a rise in water-levels on this site as a result of clear-felling and drain blocking. Furthermore in the wetter areas *Sphagnum* moss is dominating and active peat formation is likely, if conditions remain favourable.

## **10. References**

- Brooks, S. (2005). *Assessment of Project Sites, Restoring Raised Bog in Ireland*. Coillte LIFE Nature Project. Peatland Consulting
- Conaghan, J. (2003). *Raised Bog Ecological Report*. Coillte
- Curtis, T.G.F. & McGough, H.N. (1988). *The Irish Red Data Book. 1: Vascular Plants*. The Stationery Office, Dublin.
- NPWS Site Synopsis